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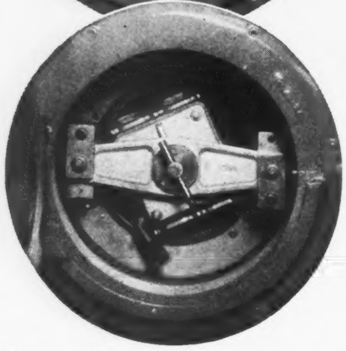
For single cylinders and large sleeves

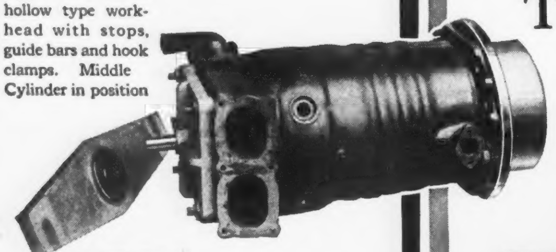
Primarily designed for handling single airplane engine cylinders, the Heald Style 72A-5 with hollow type workhead is also ideal for large sleeves and tubes.

The work is readily inserted in the workhead either from back or front. It can be located from the inside or outside, as desired, assuring that the ground hole be concentric with the outside or in any other desired plane. Held within the workhead, there is no overhang and the work can be supported at both front and rear, giving great rigidity and permitting the handling of thin walled work.

This machine can be furnished plain or automatic, depending on requirements. Already every production airplane engine manufacturer is using it, and it is equally as suitable for other types of similar work.



Upper view shows hollow type workhead with stops, guide bars and hook clamps. Middle Cylinder in position



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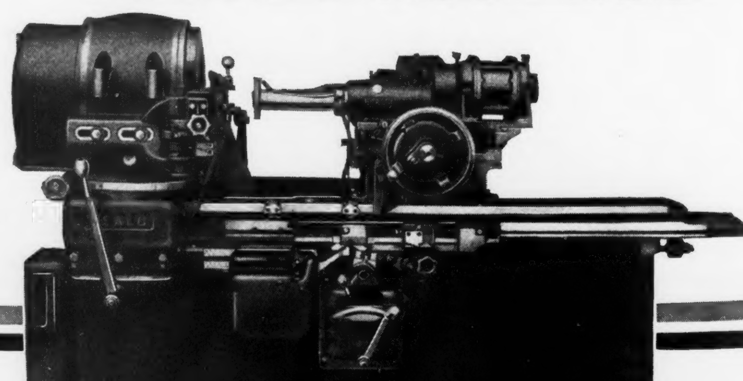
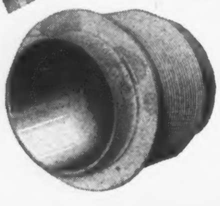




Grinds single cylinders of all types

MACHINERY

Volume 36 NEW YORK, NOVEMBER, 1929 Number 3

New Cylinder Line Reduces Packard Costs

The Latest Types of Machine Tools, Work-handling Conveyors, and An Unusual Chip Disposal Installation Make Higher Efficiency Possible

By CHARLES O. HERB

EXTENSIVE changes in manufacturing methods made during the last few years at the Packard Motor Car Co.'s plant, Detroit, Mich., have enabled that concern to sell automobiles of even higher quality than those of former years at considerably reduced prices. Modern machines have been installed in all departments wherever advisable, and new methods adopted, in the effort to cut production costs as far as possible, consistent with accuracy.

The cylinder block department is typical of those departments in which many important changes were made. In addition to new machine tools arranged in logical sequence, roller conveyors reduce manual labor to a minimum, and there is a conveyor beneath the floor that automatically carries all chips away from the machines to briquetting equipment. Here the chips are pressed into hard cakes ready to be remelted at the foundry. This chip disposal system keeps the department clean and eliminates the chip trucking and much of the sweeping necessary in other plants.

Some of the more important machine operations on the cylinder blocks will be covered in this article. September MACHINERY contained an article describing the chip disposal system in detail. The department is tooled up to produce 180 small eight-cylinder blocks per nine-hour day. These cylinder blocks are high-grade iron castings made from a foundry mixture containing about 20 per cent steel scrap. They weigh approximately 100 pounds each.

All Four Sides are Milled in Drum-type Continuous Machines

The top, bottom, and two sides of the cylinder blocks are rough- and finish-milled in two heavy Niles drum type continuous milling machines such as shown in Fig. 1. In the first of these machines, the cylinder blocks are first mounted on the right-hand side of the drum and the top is milled as they are carried past the cutters at the rear. Then the

work is shifted to the left-hand side of the drum, with the manifold side exposed to the cutters. In the second machine, the bottom of the blocks is milled while the blocks rest on the finished top surface, and the water-jacket side is machined after the blocks have been shifted to the left-hand side of the fixture.

On both machines there are, of course, two sets of roughing and finishing cutters. The former remove about 1/8 inch of stock from the various surfaces, and the latter about 1/32 inch of stock. Inserted-blade cutters 11 inches in diameter are used. Air-operated clamping devices facilitate the loading and unloading of the fixtures, although several hand clamps are also employed. The pneumatic clamps grip two blocks at a time on opposite sides of the fixture and at four or five points each. All chips drop from the cutters into a chute that leads to the conveyor beneath the floor.

The Eight Cylinders are Bored Simultaneously

Ingersoll eight-spindle machines of the type shown in Fig. 2 are used both for rough- and finish-boring the cylinder blocks; however, these two operations do not follow each other directly. Inserted-blade cutters with stellite bits are employed, the spindles being piloted above and below the cutters. Oilgear hydraulic cylinders on each side of the work-table feed the table and cylinder block to the cutters, there being a rapid approach to the point where the cuts start, a slow feed, and a quick return. The entire operation, with the exception of loading and unloading, is automatic. Extremely simple clamping means are employed, there being a clamp on each side of the fixture which forces the cylinder block back and down as the handle is moved. In this case also, chutes carry all chips to the conveyor below the floor.

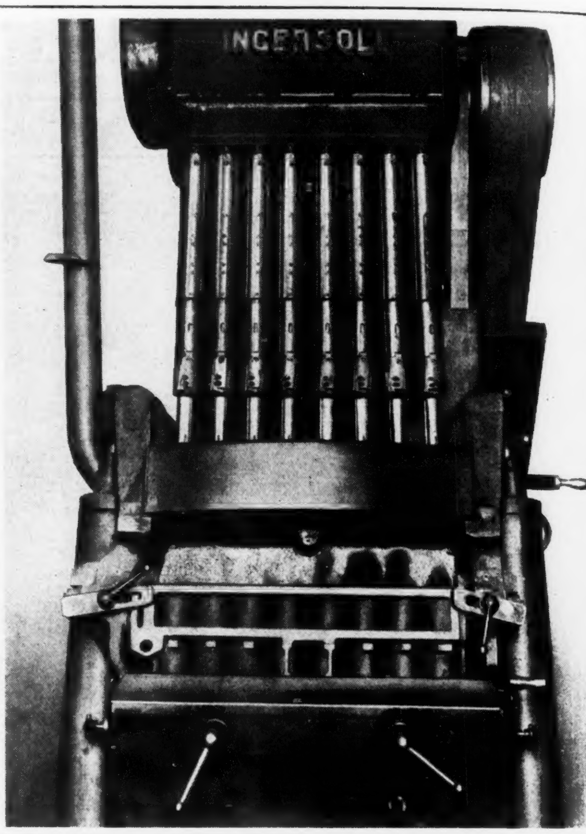


Fig. 2. Boring All Eight Cylinders Simultaneously on an Inclined Type of Machine

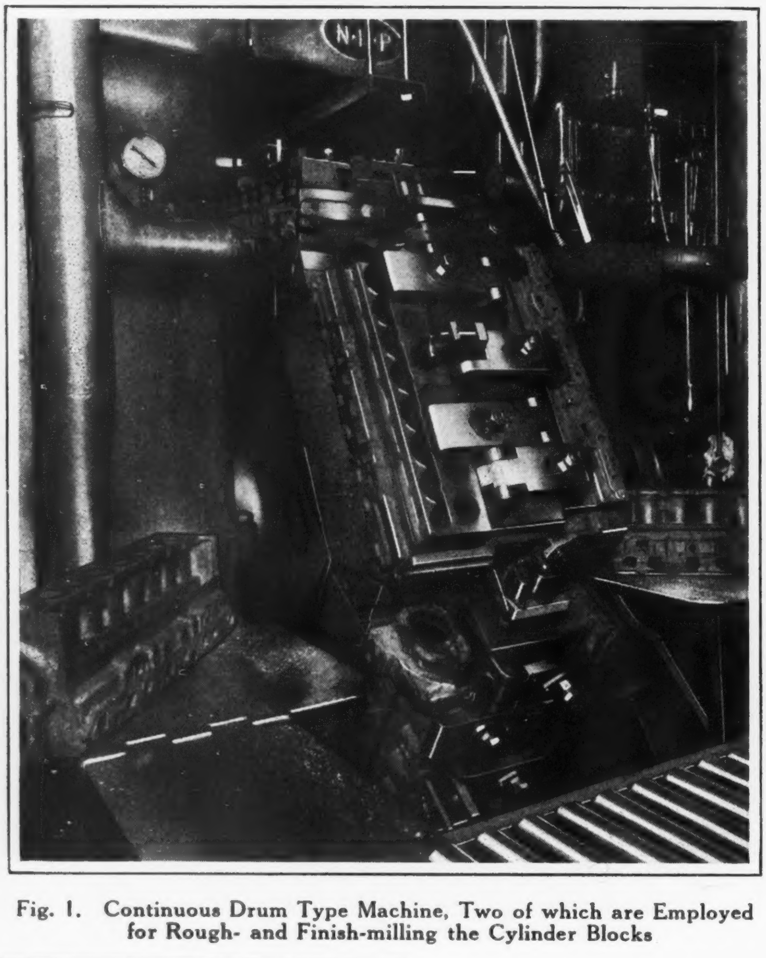


Fig. 1. Continuous Drum Type Machine, Two of which are Employed for Rough- and Finish-milling the Cylinder Blocks

In the rough-boring operation, approximately 0.070 inch of stock is removed from each side of the bores, and in the finishing operation about 0.017 inch. The reaming is done in a single-spindle machine, a reamer of one size being used for all eight bores. The reamer is only about 1 1/2 inches long, and is provided with helical inserted blades. Approximately 0.005 inch of stock is removed on each side of the bores. The reamed diameters must be 3.1835 inches within plus or minus 0.001 inch.

Using Five Drills up to 30 Inches Long Successively

On the water-jacket side of the cylinder blocks there are eight lugs *A*, Fig. 3, each about 1 inch long, with the exception of the one at the extreme left. Holes ranging from 0.4375 to 0.386 inch in diameter must be drilled and reamed through these lugs in direct line with each other to re-

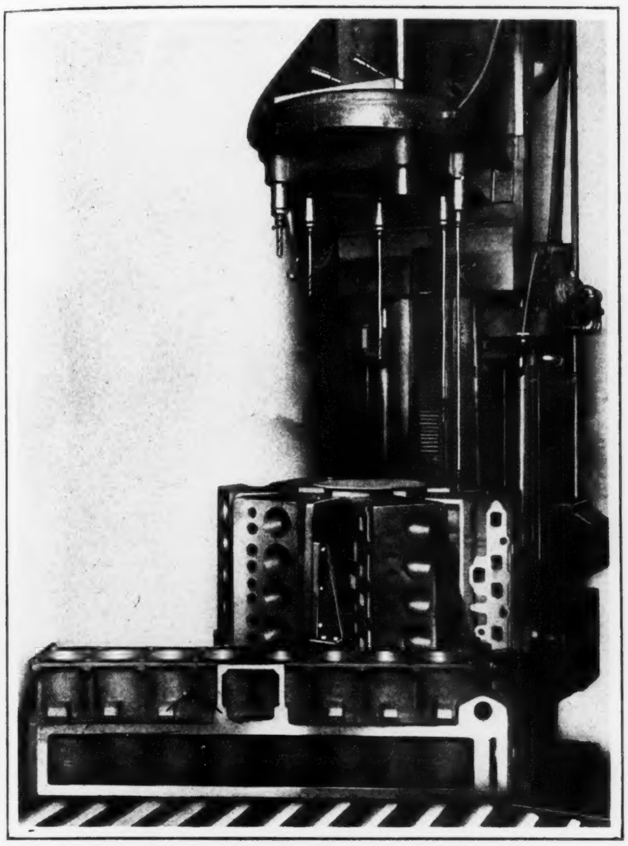


Fig. 3. Using Five Drills up to Thirty Inches Long for Drilling Eight Holes in Line

ceive a tube that may be seen in place at *A*, Fig. 4. The drilling is done with five drills of the type shown in Fig. 3, which have a short drilling portion at the lower ends and shanks that increase in length with the successive drills, the lengths ranging up to 30 inches.

A six-station fixture is employed, so that five cylinder blocks can be drilled simultaneously while new work is being loaded into the fixture at the remaining station. The first drill starts the hole in the top lug, and the other four drills each finish holes in two lugs. Thus, one cylinder block is completed at each indexing of the fixture. Raising and lowering of the drill head is automatic, but the table is indexed by hand.

After the cylinder blocks are removed from this machine, the operator line-reams the holes with a long special tool having eight reaming sections. This tool is driven by an air drill.

Machining the Valve Seats and Valve-stem Guide Holes

The Ingersoll vertical multiple-spindle drilling machine shown in Fig. 4 and in the heading illustration (the third machine from the left) is equipped with a front row of combined core-drills and ordinary drills and a back row of longer drills. The cylinder blocks, held in the table fixture, are first positioned under the front tools, which core-drill the sixteen valve-seat throats and "spot" the sixteen holes for the valve-stem guides.

When the drill rises by itself as this step is completed, the table automatically moves toward the machine column to position the cylinder block beneath the second row of drills. These finish-drill the valve-stem guide holes at the next downward movement of the head. As the head again moves upward at the end of the drilling, the table automatically returns the cylinder block to the front of the machine for reloading. Oilgear hydraulic equipment feeds the head to and from the work, each cycle of operation being started by operating the lever at the right-hand side of the table. The clamping mechanism here used is similar to that provided on the machine shown in Fig. 2.

The valve-stem guide holes are rough-reamed by the row of tools at the front of the drill head, in the second machine from the left in the heading illustration, and then finish-reamed by a similar row of tools at the back, the arrangement of the tooling and the fixture being similar to that used on the machine shown in Fig. 4. The reamers are guided above and below the cuts, and produce holes 2 1/2 inches long, which must be kept square with the cylinder block top within very close limits.

The Greenlee multiple-spindle machine at the extreme left in the heading illustration chamfers the eight piston bores and spot-faces the valve-spring seats.

One Hundred and Sixteen Holes Drilled at One Time

Four heads, three horizontal and one vertical, are provided on the Ingersoll machine illustrated in Fig. 5, for drilling 116 holes simultaneously in the cylinder blocks. Each drill head is equipped with a separate driving motor, and all four heads are

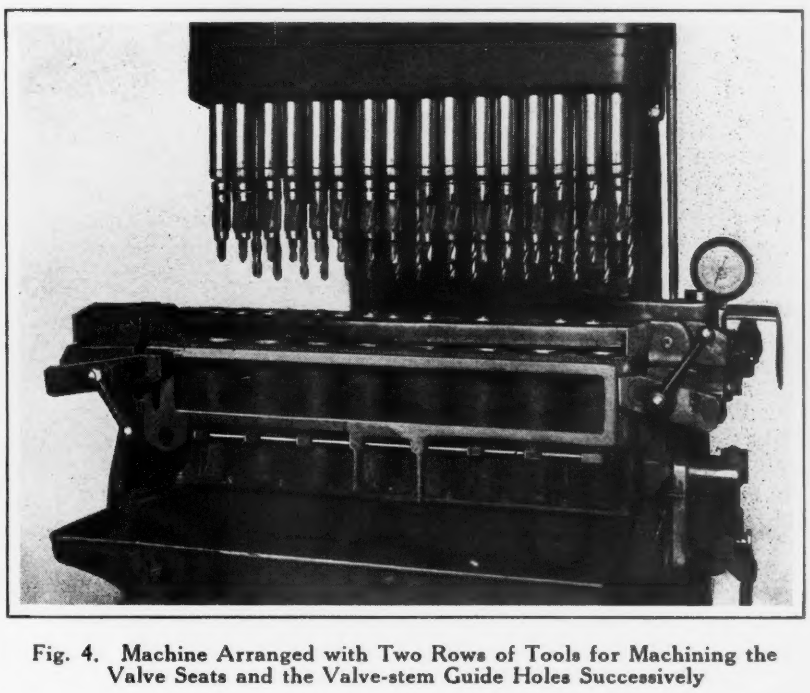


Fig. 4. Machine Arranged with Two Rows of Tools for Machining the Valve Seats and the Valve-stem Guide Holes Successively

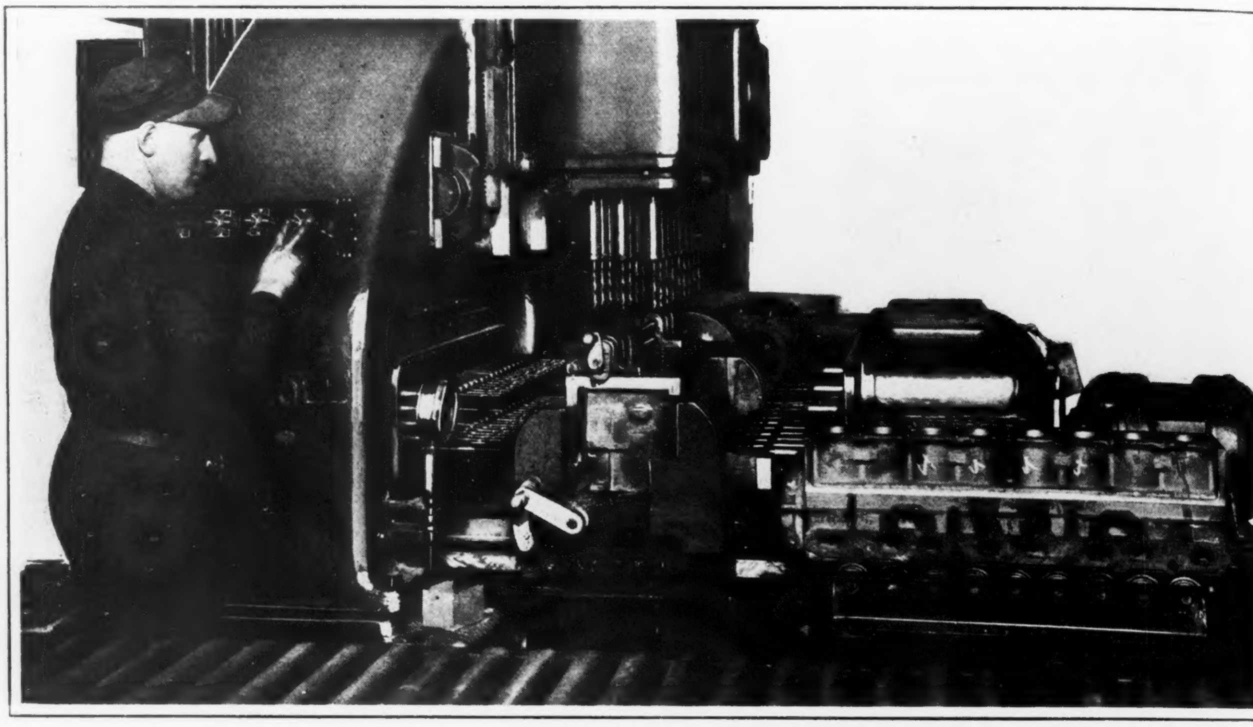


Fig. 5. Four-way Machine on which One Hundred and Sixteen Holes are Drilled Simultaneously

actuated by Oilgear hydraulic equipment, the operation being effected automatically through a lever.

In loading the fixture, there are only two levers to move. One serves to enter a locating pin in a dowel-hole specially reamed to provide a locating means for various machining operations, and finally used as a stud hole. The second lever brings the clamps down on the cylinder casting. A similar machine, immediately to the left of the one illustrated, taps ninety-five of these holes.

Assembling Valve-stem Guides in Minimum Time

The sixteen valve-stem guides are pushed into place at one time on the 15-ton arbor press shown in Fig. 6. All the guides are first slipped into bushings in plate *A*, which is then located on the cylinder block, as shown, by means of plugs that enter the end valve throats. Next the cylinder block is pushed back into the desired position on the table and the press ram is operated, which brings sixteen individual rams or pushers *B* into contact with the upper ends of the valve-stem guides. The guides are thus pushed into the cylinder block as the machine completes its stroke.

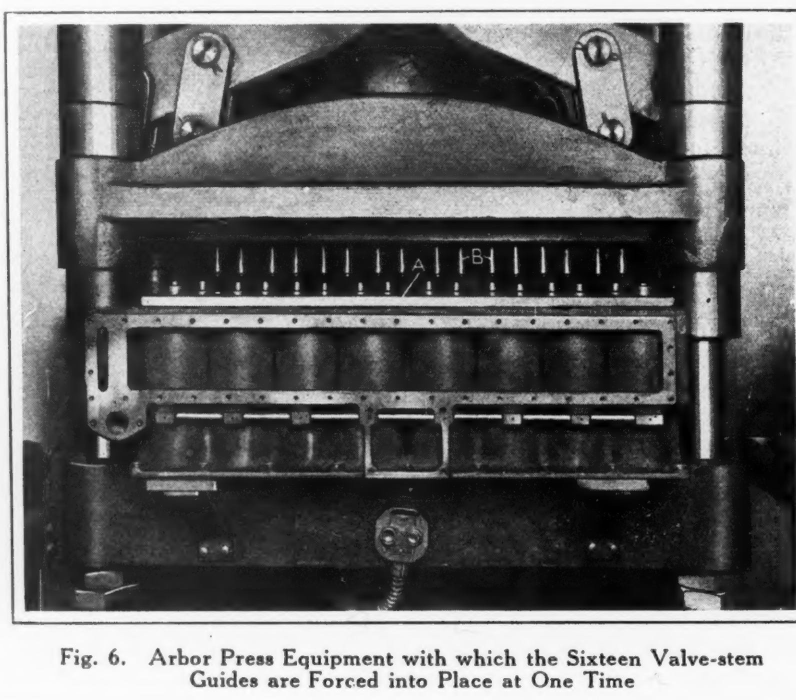


Fig. 6. Arbor Press Equipment with which the Sixteen Valve-stem Guides are Forced into Place at One Time

The Cylinder Bores are Rough- and Finish-honed

Approximately 0.003 inch of stock is removed on the diameter from the eight cylinder bores while they are being honed in the Barnes Drill Co.'s machine shown in Fig. 7, which is equipped with eight Hutto heads. At the end of this operation, the bores must be true to 3.1865 inches within plus 0.0005 inch or minus 0.0015 inch. The heads are set to be gradually expanded to predetermined points as the individual handles at the upper ends of the heads are moved while the honing is in process. At the end of the operation, the heads are automatically contracted within the bores before they are removed. In this operation, the table and cylinder block remain stationary, while the heads are moved up and down.

Finish-honing of the cylinder bores is accomplished in a similar manner in the Hutto machine illustrated in Fig. 8, with the exception that

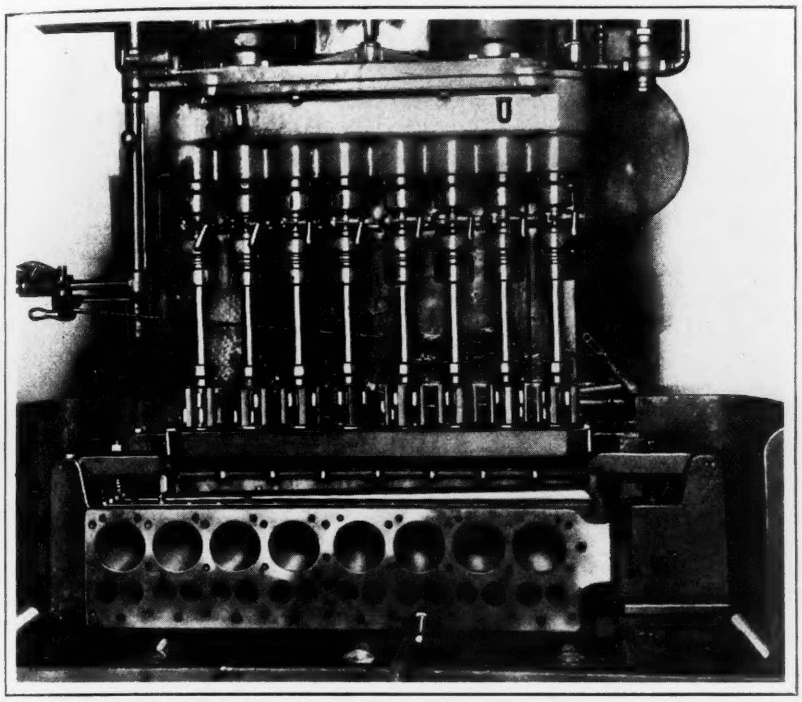


Fig. 7. Equipment Used in the Rough-honing Operation on the Cylinder Bores

in this case the machine table moves up and down to traverse the cylinder bores along the revolving heads. The bores are finish-honed to 3.1875 inches within plus 0.0015 inch and minus 0.0005 inch, about 0.001 inch of stock on the diameter being taken off in the operation. When the cylinder blocks leave this machine, the bores must not be out of line more than 0.0005 inch, and must not taper more than 0.0005 inch in the entire length of 9 1/8 inches; if there should be any taper in the cylinder bore, the small end must be at the top of the bore.

Both the rough- and finish-honing operations last about two minutes. Lubricant is copiously supplied to all hones, the lubricant consisting of about 60 per cent kerosene and 40 per cent mineral seal oil. At the end of the finish-honing operation, all reaming marks have entirely disappeared from the bores, leaving a highly polished surface.

* * *

According to a recent news item, a heavy steam locomotive equipped with Timken roller bearings is being built by the American Locomotive Co. While roller bearings are in use on passenger cars, it is said that this will be the first case in which they have been used for the heavy driving wheels of a locomotive. The smaller wheels on the tender and the connection between the main driving rod and the side-rod will also be equipped with roller bearings.

WELDING MONEL METAL

Successful welding, as applied to monel metal, requires a few simple precautions, which are suggested by the Linde Air Products Co. A neutral flame should be used with a tip one or two sizes larger than would be needed for welding steel of equal thickness. Cold-drawn monel metal strips or wire are used as a welding rod. As a rule, a flux is not required, due to the oxide skin forming on the surface of the puddle and protecting the underneath metal from further oxidation. Keeping the outer envelope of the flame spread over the weld area also aids in preventing oxidation, by excluding the air. The rod should be melted beneath the oxide skin, while dirt particles, etc., should be worked to the outside by melting beneath them. The weld should be built up well above the surface, so as to allow the skin of oxide and slag to be ground off, thus leaving sound metal only in the weld.

Uneven heat applied to monel castings will produce distortion, and it is necessary to preheat carefully to a temperature of approximately 1200 degrees F. at the same time supporting the casting so that it will not collapse or become distorted under its own weight. When the weld is completed, all openings in the preheating furnace should be closed with asbestos paper, allowing the casting to remain until it is absolutely cold. Success in welding monel metal is largely dependent on the care taken in the cooling or annealing process.

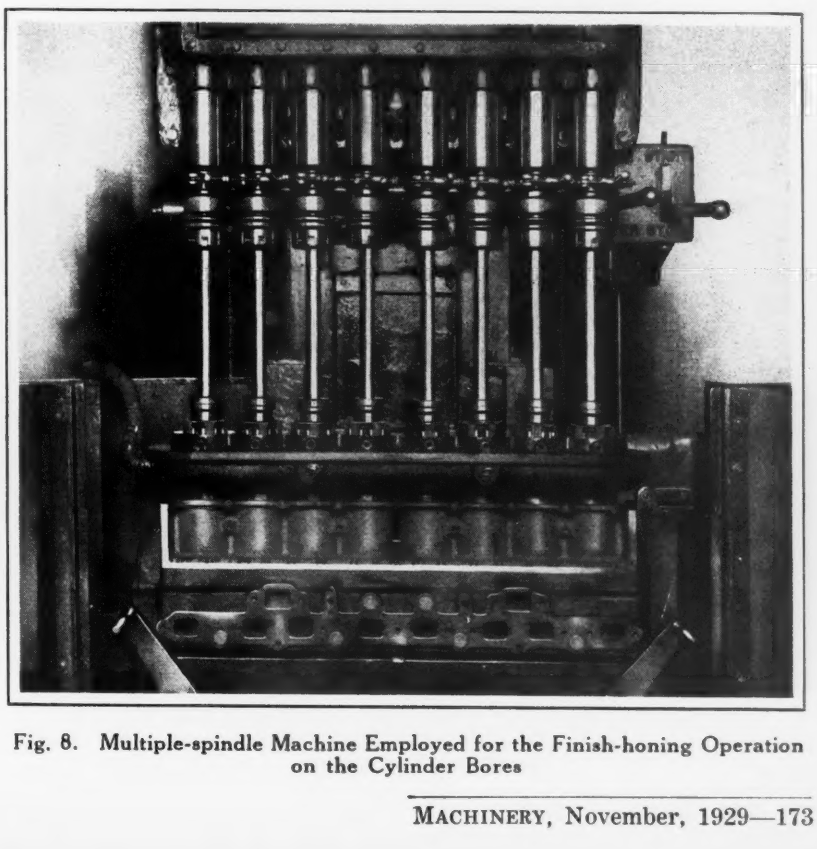


Fig. 8. Multiple-spindle Machine Employed for the Finish-honing Operation on the Cylinder Bores

Special Tools and Devices for Railway Shops

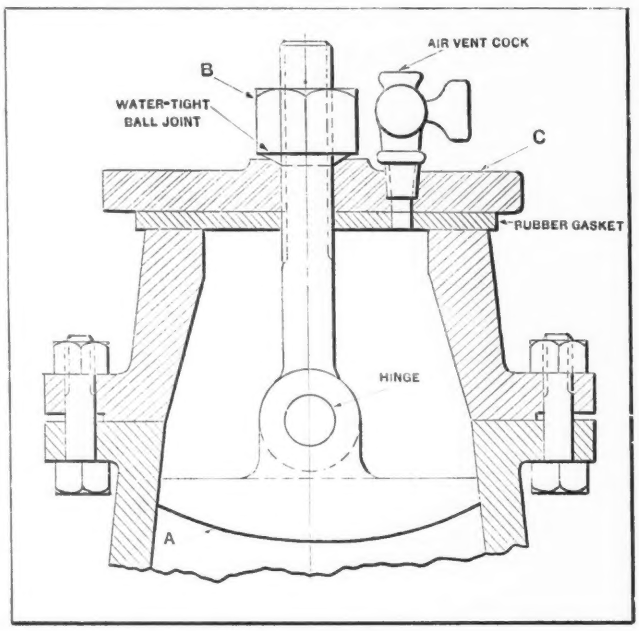
Equipment Employed in Locomotive Repair Shops, Selected by Railway Shop Superintendents and Foremen as Good Examples of Labor-saving Devices

FLANGE FOR SEALING LOCOMOTIVE EXHAUST PIPE

By H. H. HENSON, Foreman, Machine and Erecting Shop, Southern Railway Co.

The illustration shows how a locomotive exhaust pipe can be sealed for a hydraulic test for leaks in steam pipes, exhaust pipes, and superheater unit joints. The way this job is usually done in the roundhouse is to seal the opening with a gasket and a block of wood. The latter is held tightly in place by the pressure of a heavy jack. This method consumes approximately two hours, while with the tool shown, the same work can be done in five minutes. Also, when using a jack, other joints in the exhaust pipe are forced together, and there is no way of knowing whether or not these joints will leak after the pressure of the jack is removed.

In applying the tool to the exhaust pipe, the link *A* is turned enough to enter the pipe, after which it is turned again to the position shown. Nut *B* is then tightened, drawing plate *C* down on the rubber gasket and making a water-tight joint. The vent cock is left open until all the air is expelled from the pipes while they are being filled with water.

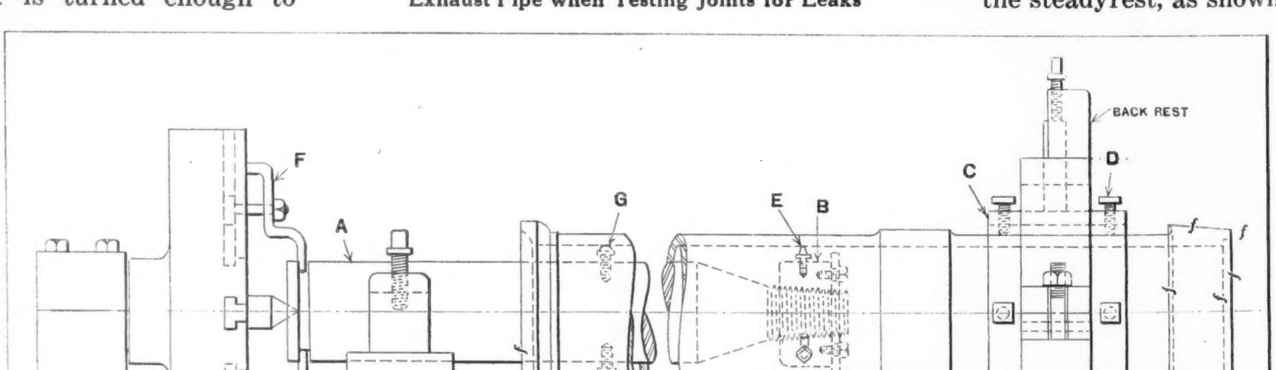


Flange with Special Clamping Arrangement for Sealing Exhaust Pipe when Testing Joints for Leaks

TURNING A LONG DRY PIPE

By E. A. LOTZ, Shop Foreman, Pennsylvania Railroad Co.

In a certain shop, a locomotive dry pipe 4 feet longer than the longest lathe available had to be machined. To avoid the delay and expense of shipping the job to another shop, an arrangement was devised as follows: A mandrel *A* and a taper threaded split nut *B* were made from scrap axle material, while the steadyrest guide bushing *C* was turned from an old side-rod bushing. The tailstock was removed and replaced by the steadyrest, as shown.



Lathe Set-up for Turning a Locomotive Dry Pipe Too Long to Place between Centers

Mandrel A was inserted into one end of the pipe with enough of the pipe left protruding to provide room to machine the inside of the ends. Set-screws E in the split nut B are adjusted just close enough to admit the mandrel into the pipe, after which a chain wrench is used to screw the taper threaded portion tightly into nut B. This action expands the split nut and forces the three set-screws E solidly against the inside of the pipe. The pipe is then placed in the lathe and drawn against the lathe center by straps F, after which the proper adjustments are made with the four set-screws G and the eight set-screws D to insure true running conditions. To machine the counterbored end, the pipe is reversed and the previously machined parts are trued up by the method described.

* * *

BEST METHODS FOR POLISHING ALUMINUM

The following information on the subject of polishing aluminum was given in an article by A. Rousseau, of the sales engineering staff of the Norton Co., Worcester, Mass., which was published in *Grits and Grinds*:

Aluminum articles are usually made by one of three different methods: They are either cast in sand, die-cast in molds, or formed from sheets in power presses. Practically all aluminum articles are polished. The metal is soft and ductile and is easily cut, but in many instances, sand or small pit holes must be removed. This is done by polishing with an abrasive.

The size of abrasive and the type of polishing wheel to be used depends upon the method used in manufacturing the part to be polished and the size, shape and condition of the part previous to polishing. The amount of material to be removed also affects the size of the abrasive. Each type of article presents a different problem, and the ultimate finish must receive consideration according to the particular article. Sand-cast pieces have a rough outer surface similar to a molded casting. Die-castings present a fairly smooth surface, and on sheets it is only necessary to remove the press marks.

It is a loss of time to use abrasive that is either too fine or too coarse for roughing, when a high finish is desired. Time gained in roughing, using coarse abrasives, will be lost on the following operations in removing the marks left by the roughing operation; too fine grain sizes reduce the rate of production and at the same time do not give a materially better final finish.

On heavy castings, where considerable metal is removed, the first roughing operation can be successfully done with No. 60 Alundum abrasive set up on a sewed buff, felt, or canvass wheel. The sewed buff, which is the most resilient and follows the shape of the work best, should be used for round or formed work.

Sand-cast pieces, with small pit holes and rough exteriors, are most successfully roughed with a greased wheel of not coarser than No. 60 Alundum grain. After roughing with No. 60 grain, the next operation can be performed with No. 90 or 100 grain, depending upon the finish desired. There are some instances where an additional operation is necessary. In such cases wheels set up with No. 180 or No. 200 grain are used. On die-cast pieces that are fairly smooth, from No. 90 to 150 or 180 Alundum abrasive can be used.

The polishing of sheets is readily done on a felt wheel set up with no. 180 Alundum, and buffed with a felt wheel which gives a much better finish than a cotton buff. On sheets and flat work, it is advisable to change the direction of the strokes when changing from one size to the next finer. This will help to obliterate the scratches left by the coarser grain. Many sheets on which only the press marks must be removed can be polished directly with a buffing wheel using Tripoli for the polishing agent. No coarser abrasive is necessary in this instance.

On work that is painted instead of buffed, the uniformity of the grain is most important. This is especially true of work finished in lacquers of a light finish. Over-size grain will not break down, but will leave its mark on the surface, which is very easily distinguishable.

Successful finish or polish depends chiefly upon two points. First, the care that is used in preparing the article for the final buffing, and second, a plentiful supply of grease, tallow, or some other lubricating agent used on the polishing wheels. All roughing scratches must be removed in the fining operation. Work not properly finished on the fining wheel comes from the buff wheel with a high color but rough appearance. This is caused by the buff wheel dragging in the scratches and making them deeper.

The use of plenty of grease in all polishing operations on aluminum will mean a much better eventual finish. If a wheel becomes too dry, it matters little what size abrasive is used, for it will imprint marks as deep as the amount of metal load on its face. Grease sticks sold by platers' supply houses, beef tallow, suet, kerosene, or an oil rag applied to the wheel reduce loading and dragging of the work and at the same time improve the quality of the finish for the final or buffing operation. If plenty of lubricant or grease is not used, the buffing operation is harder on the buffing wheel, and the buff may drag in the pits and holes, producing a poor finish.

In obtaining the final finish, Tripoli is sometimes applied on the buff wheel to help cut the metal and obtain what is termed the "Bottom." After the Tripoli, a silica compound may be used to remove buffing marks and give color. Where a high color is desired, lime and rouge are sometimes employed.

* * *

I am wondering whether too many employers do not impose an unnecessary measure of repression upon their employes. I am inclined to conclude that many of them do. Every man must be given proper room to grow or he does not grow as he should or could.—*B. C. Forbes*, in *Forbes Magazine*

Cooperative Education Aids Industry

How Well Educated Young Men Firmly Grounded in Practical Work are Made Available to Industrial Organizations

By FREDERICK M. TRUMBULL, Vocational Director, Rockford, Ill.

TECHNICALLY trained men are required in ever-increasing numbers to carry forward the progressive aims of modern industry. To meet this demand our schools and colleges turn out graduates well versed in theories, but most of whom, unfortunately, possess only limited knowledge concerning the practical conditions they have to meet. Many engineering graduates particularly, after receiving their degrees, find themselves obliged to pass through a rather disappointing and unproductive period before they are fitted for worthwhile positions.

Frederick M. Trumbull

Cooperative Education Combines School Studies with Practical Work

Recognizing the need for including in a college course a certain amount of practical work, a number of engineering colleges have adopted the cooperative plan of education which was conceived twenty odd years ago by Herman Schneider, Dean of the University of Cincinnati. Under this plan, students spend a large percentage of their time in industrial plants doing real work with up-to-date equipment instead of performing elementary operations in a college shop equipped with machinery, much of which tends to become obsolete long before it is discarded. While in the shop the students are considered regular employes of the company, are under the authority of the shop foreman and higher executives and are paid fair wages for the work done. Throughout the college terms, the shop work and the schoolroom studies are correlated as far as practicable, so that the students will thoroughly understand both the theoretical and the practical sides of the problems met.

When men graduate from these cooperative courses, it is not necessary for them to pass through the period of virtual apprenticeship that the inexperienced student must serve after the completion of a conventional engineering course. The graduate from a cooperative course in engineering has a decided advantage over the typical "cub engineer." He is ready for practical service.

Cooperative education has another important advantage to the students, in addition to equipping them for immediate practical service. Many who otherwise could not afford to go to college, are able, at least partially, to support themselves while they are obtaining an education. In the latter part of the course, they may become practically self-supporting.

Cooperative Education Has its Largest Application in High Schools

Desirable as the cooperative plan of education is for engineering colleges, it should have a far greater application in high schools, for several important reasons. In the first place, if a student plans to follow the engineering profession, the high school should furnish him with the opportunity of obtaining practical experience so that he can determine for himself whether he is suited to the profession and likely to be a success in it before he matriculates at an engineering college. Then, too, the student may be planning to enter an engineering college where the cooperative program is not followed, and in such a case, practical experience is put off until after he receives his degree. Misfits in industry are eliminated by cooperative education in the high school.

Another important reason for instituting the cooperative system of education in high schools is that many high school graduates cannot go to college or do not choose to do so. With the cooperative plan, boys can serve apprenticeship courses in shops while they are going to school, and will graduate, not only with a high school diploma, but better trained for the work of industrial concerns than if they had served apprenticeships in shops alone.

Ordinary High School Courses do Not Appeal to All Students

Upon the completion of a national survey reported by the United States Bureau of Education in 1925, it was found that out of one thousand boys

FREDERICK M. TRUMBULL was born on a farm near Rockford, Ill., in 1878. He is a graduate of the University of Chicago, and obtained a master's degree in industrial education at the University of Wisconsin. After having taught for four years, he turned to industrial work and was engaged first in the gas engine field and later in the electrical field, where he managed a light and power station, at the same time operating a sales and contracting business. Meanwhile he retained an active interest in educational work, and in 1920 returned to this field as special supervisor in the Rockford, Ill., school system, in charge of the Continuation School, vocational guidance activities, and a placement service to help young workers to find suitable employment. He is now vocational director in charge of all vocational work in the Rockford schools, including the half-time cooperative plan. Mr. Trumbull has had an unusual opportunity, through his teaching and industrial and business experience, to obtain a firm grasp on vocational educational problems. His recent book "Guidance and Education of Prospective Junior Wage Earners" has just been published by John Wiley & Sons, Inc.

and girls enrolled in the first five grades of elementary schools, only 139 completed high school. The interesting point about this report is not the number of children who left school before graduation, but rather the comparatively small percentage of children who quit because of economic necessity. Only 27.5 per cent dropped out for this reason, whereas 66 per cent left school because of lack of interest in academic education.

Cooperative education has proved the means of creating a desire in boys to continue going to school. It provides them with a means of doing interesting work while educating themselves, and gives them the chance of earning money, which is a dazzling attraction for so many youths of high school age. Also, boys taking cooperative courses soon appreciate the immediate value of school stulies in their practical application to the problems of life. The constantly increasing number of cities adopting the cooperative plan of education in high schools bespeaks its success.

Rockford Industries Cooperate Wholeheartedly with the High School

The city of Rockford is peculiarly well adapted to the application of the cooperative plan of training boys to become machinists, because there are a number of large plants there engaged in building machinery and machine tools. These plants are willing and anxious to cooperate with the school to enable boys to learn a trade while earning a high school diploma. A special plan has been developed in which boys enrolled in the third and fourth years of high school are apprenticed to the various industrial concerns and alternate two weeks in the shop with two weeks in the schoolroom. In addition to the regular high school subjects, such as English, history, physics, and mathematics, the courses for cooperative students include a special study of the technical subjects related to the trade they are learning. These students are required to learn how to use a handbook in the practice of their trade; for instance, each student following the machinist trade is required to own and use MACHINERY'S HANDBOOK. Students who graduate from these courses have the best possible preparation for rapid advance in industry or for entrance into a college course in engineering.

Some of the Details of the Rockford Plan

Under the Rockford plan, boys following cooperative courses are apprenticed in pairs, so that while one boy is attending school the other one is taking his place in the shop. The school continues in session forty-eight weeks each year. Each school week for these students consists of 5 1/2 days, and they attend school 45 minutes longer each day than the regular academic high school students. In this way, the cooperative students are able to cover the same amount of school work in a year as the regular students, even though they spend half their time on shop work.

Upon completing this two-year, half-time cooperative course, the boys are qualified to attend college if they choose. The employers have agreed to allow them to continue half-time in their shops while attending college on a cooperative plan if they elect such a course. Or instead, they may continue full-time with their employers to complete a specially supervised apprenticeship course. Boys choosing the last-named alternative attend school four hours each week for continued technical instruction for two years after graduating from high school.

Cooperative Training is Advantageous to All Concerned

Industry as a whole recognizes its responsibility for training the skilled men that it requires, and many large concerns conduct apprenticeship courses for this purpose, but most plants find the theoretical instruction of apprentices a burdensome duty. It is economically impracticable to hire an expert teacher for the comparatively few apprentices ordinarily employed in any one plant. This is where the high school performs an important service to the entire community, since a minimum number of qualified teachers can provide the school instruction for all the apprentices from a considerable number of plants.

On the other hand, it is financially impossible for high schools, or universities for that matter, to duplicate the machine equipment of manufacturing methods of industrial plants. Whatever equipment schools may obtain through appropriations tends to become obsolete within a few years, whereas the average shop finds it economically advantageous to keep its machinery up to date. It would not be reasonable, therefore, to suppose that schools could turn out toolmakers or machinists, for instance, as expert as those serving apprenticeships in shops.

Cooperative training, as conceived and carried forward under the Rockford plan, is fundamentally a preparation for eventual leadership in Rockford's industries. Because it is so conceived and because the "Co-op" boys have won the confidence and respect of their employers, fourteen firms are now participating in the plan and seven additional firms are asking for the assignment of one or more pairs when the next group, which will be the third group, is started in January, 1930. The first group was started in January, 1928. Obviously, by offering the facilities of their shops to students following cooperative courses, Rockford's industrial concerns are merely availing themselves of a rational method of training their future master mechanics and executives.

* * *

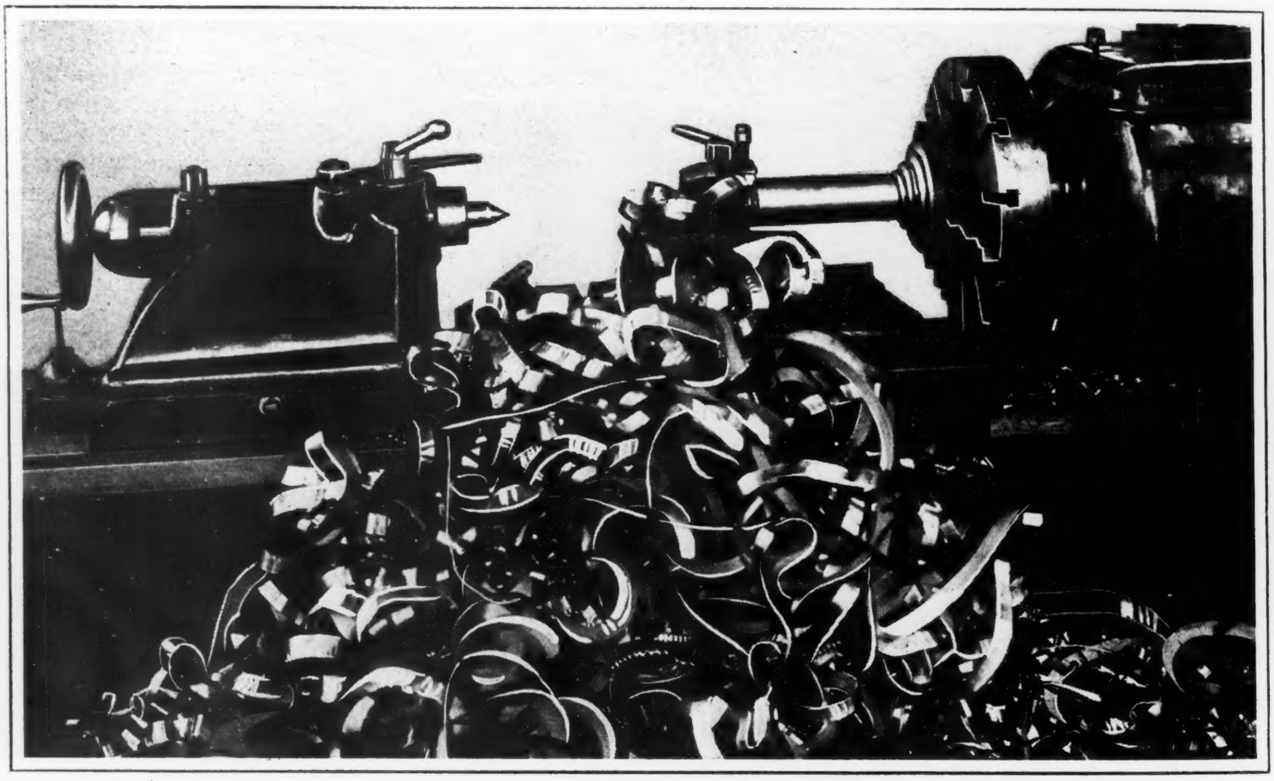
DEMONSTRATION CAR FOR ELECTRIC TOOLS

An interesting demonstration car is being used by some of the salesmen representing the Van Dorn Electric Tool Co. of Cleveland, Ohio. The car consists of a specially designed closed body mounted on a regular chassis. A large rear door, when open, shows the various electric tools so arranged that they are accessible for immediate use.

HEAVY CUT TAKEN BY TUNGSTEN-CARBIDE TOOLS

It has often been contended that it is not possible to take heavy cuts with the new tungsten-carbide tools, and that they are mainly suitable for comparatively light cuts at very high speeds. The accompanying illustration rather disproves this statement. The secret of being able to take heavy cuts with these new tools seems to be mainly to provide a sufficiently heavy machine tool, without chatter. The work must also be held firmly.

The illustration (from the publication *Carboloy)* shows an 8-inch round bar of S.A.E. 1045 steel being cut with a Carboloy tool, the depth of the cut being 1 1/4 inches, and the feed 0.010 inch. The work revolves at 303 revolutions per minute, the maximum surface speed being 635 feet per minute. The bar was held in a chuck and projected 18 inches without a tail-center support. This, of course, was done merely to show the possibilities of the tool and the machine. No coolant was used. The bar was turned down from 8 to 2 inches in diameter without redressing the tool.



Taking a Cut 1 1/4 Inches Deep, 0.010 Inch Feed, with a Carboloy Tool

* * *

In a discussion on the design of fuel pumps at a recent meeting of the American Society of Mechanical Engineers, attention was called to the importance of taking into consideration the compressibility of the liquid. Oil, like other liquids, is compressible, although we generally think of liquids as retaining a constant volume under ordinary pressures. It was pointed out, however, that at a pressure of 6000 pounds per square inch, the volume is reduced about 4 per cent.

MACHINERY EXPORTS CONTINUE TO INCREASE

The upward trend in the exports of American industrial machinery continued during July, the last month for which complete statistics are available. Foreign sales in that month amounted to nearly $23,000,000, an increase of approximately 10 per cent over the preceding month, and 22 per cent over the corresponding month in 1928. During the first seven months of the year, American industrial machinery exporters sold abroad equipment valued at more than $152,000,000, or over $31,000,000 in excess of the first seven months of 1928.

During July, 1929, metal-working machinery was exported to a value of $3,546,000, as compared with $3,127,000 during the same month a year ago. In the first seven months of this year, exports of metal-working machinery have amounted to over $24,500,000, as compared with $18,250,000 during the same period a year ago. Sales of engine lathes, turret lathes, gear-cutting machines, pneumatic portable tools, planers, shapers, and internal grinding machines have all gained. The exports of sheet metal working machinery, foundry and molding equipment, rolling mill machinery, and forging machinery have almost doubled.

* * *

The work of reclaiming the Zuyder Zee in Holland is well under way. This sea is 85 miles long by from 10 to 45 miles wide, and its average depth between 11 and 12 feet. When the dikes are built, it will be necessary to pump out the water. The cost is estimated at $200,000,000.

Grinding Thin Knives in Large Quantities

Standard Machines Equipped for the Accurate Grinding of Radial, Helical, and Straight Knives 1/32 Inch Thick

WHILE machine tool builders are engaged primarily in the production of standard equipment, they are frequently called on to provide their machines with special attachments and fixtures designed for doing unusual jobs. Two standard machines have recently been equipped by the Brown & Sharpe Mfg. Co., Providence, R. I., for the production grinding of thin knife blades used in a special machine for cutting patterns where accuracy is extremely important. In order to insure the required accuracy, it is necessary for the knives to be ground to within close limits.

Three types of knives—straight, radial, and helical—are ground in these machines. The radial knives are made in sizes ranging from 3/4 to 11 inches in length, and have two inner radii, 7.844 and 7.7818 inches, respectively, these dimensions being held to size within plus or minus 0.001 inch. Fig. 2 shows an outline of such a knife.

The helical blades vary from 3/4 to 7 inches in length, with an inner radius of from 16.830 to 16.928 inches. The straight knives are made in lengths up to 15 1/4 inches, and are cut and ground to smaller lengths as required. The thickness of all the knives is 1/32 inch, and the dimension is held to size within from 0.001 to 0.002 inch, plus or minus.

A No. 2 universal grinding machine and a No. 2 surface grinding machine were equipped with special holding fixtures, loading blocks, etc., to obtain the correct cutting form on these various knives. A special wheel-stand is used on the universal grinding machine, and special gages insure accuracy and uniformity of the knives ground.

Grinding Radial Knives

The circular fixture shown at *A*, Fig. 1, is used for grinding the inside and outside edges of radial type knives. This fixture is placed over the loading block *B* after the knives have been placed around this block in stacks of ten each, end to end. From 40 to 160 knives can be loaded at one time, depending upon their length. After fixture *A* has been loaded, it is clamped to faceplate *C* and mounted on the work-spindle of the machine, as shown in Fig. 3. With the work fixture positioned as indicated at *A*, Fig. 5, the outside edges *A*, Fig. 2, of the knives are ground until they pass gages *D*, Fig. 1. Indicator *E* at the front of the table is then set to zero. In grinding subsequent knives of the same dimensions, this indicator is used instead of the gages to determine when the knives have been ground to size.

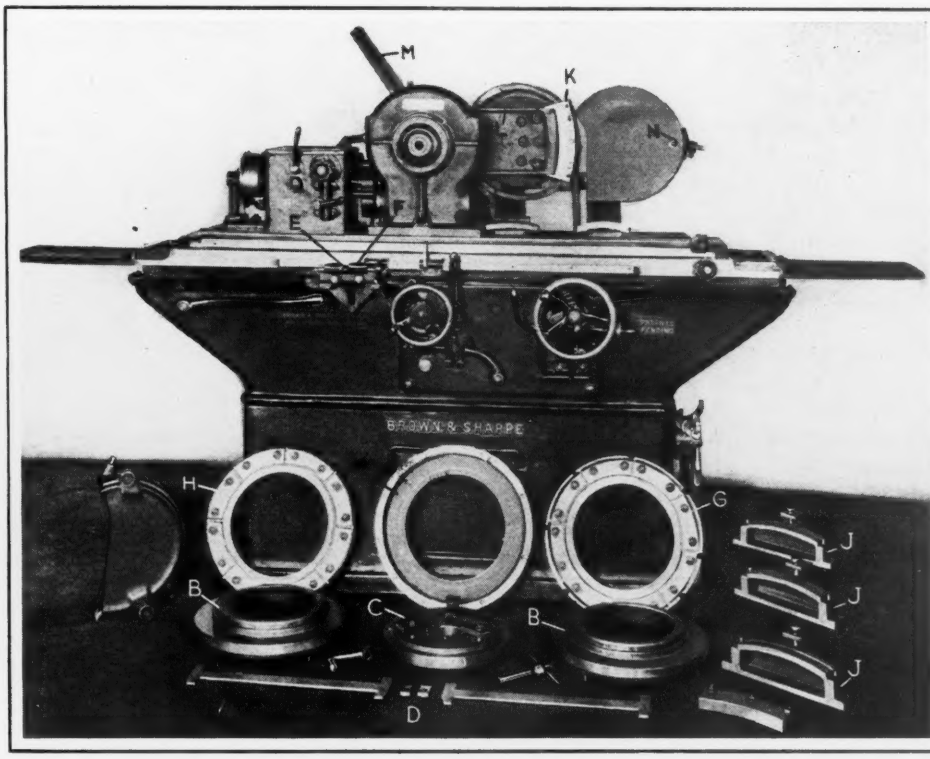


Fig. 1. Universal Grinding Machine Equipped for Grinding the Inside and Outside Edges of Thin Radial and Helical Knives

When this first operation is completed, the grinding wheel is withdrawn into the clearance position shown in Fig. 5 and the work is moved into position *B* by revolving the table handwheel. The grinding wheel is then again advanced into the grinding position and the inside edge *B*, Fig. 2, of the knives is ground. When the knives have been ground to size, as determined by means of a micrometer, the second indicator *F*, Fig. 1, is set to zero. The grinding wheel is then withdrawn, new knives are loaded in the fixture, and the operation repeated by using indicators *E* and *F* to determine when the work is finished.

The bevels on the cutting edges of the knives are ground with the knives loaded in either fixture *G* or *H*, Fig. 1, depending on the radius. After the fixture has been loaded, it is clamped to the faceplate on the work-spindle. In grinding, the swivel

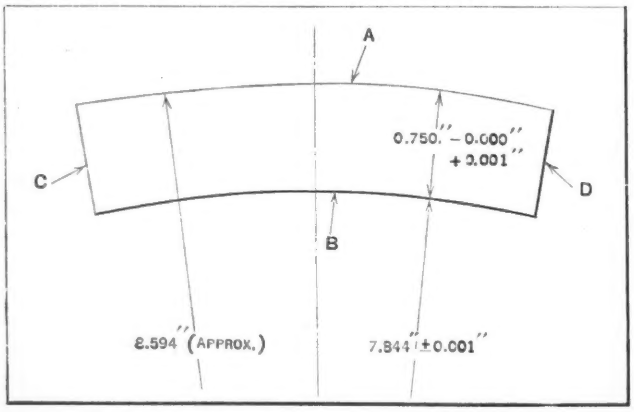


Fig. 2. Outline of a Typical Radial Knife

table is moved through the correct arc. The work is checked with a special indicating gage, and when it has reached the correct size, indicator *F*, Fig. 1, is set to zero. To grind the opposite side of the bevel on the knives, the fixture is merely turned around and the operation is repeated.

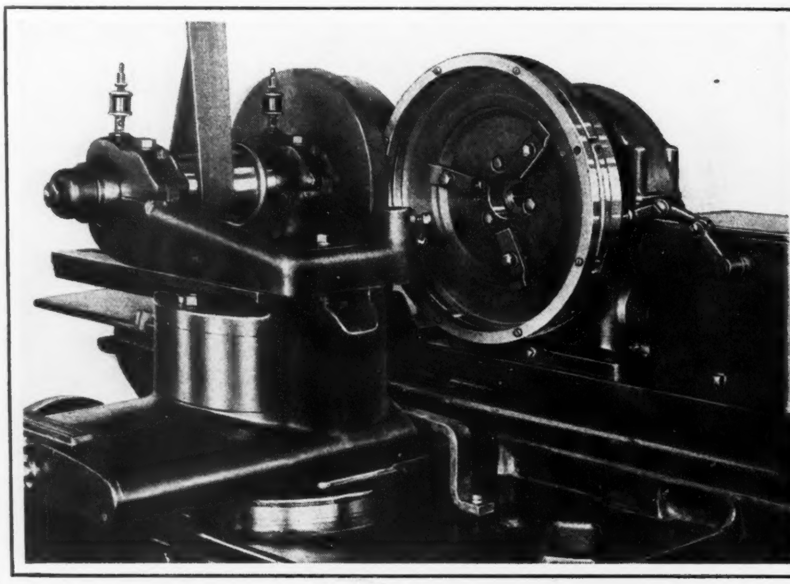


Fig. 3. Grinding the Outside Edge of Radial Knives Arranged in Stacks of Ten around a Cylindrical Chuck

Fixtures Used for Helical Knives

The method of grinding helical knives is similar to that followed with the radial type, but the larger radii of the helical knives necessitate the use of different holding and loading fixtures, such as shown at *J* and *K* in Fig. 1. The holding fixtures are bolted to a special arm *L* which travels in the sector of a circle, of which the work-spindle is in the center. The arm movement is reversed by the action of two trip-dogs. Ten knives are handled at one time.

The inside edge of the helical knives is first ground with the fixture in the position shown in Fig. 1, relative to the grinding wheel. When the grinding has been completed, the wheel is backed off and the table moved longitudinally to bring the outer edge of the knives in contact with the wheel. The knives are checked by means of the swinging gage *M* which has three interchangeable blocks to suit different radii.

How Straight Knives are Ground

Straight knives are ground on the surface grinding machine equipped, as shown in the illustrations Figs. 4 and 6, with a 24-inch table and a magnetic chuck, which is mounted on brackets in such a way that it can be swung around a horizontal axis. A bar at the rear of the chuck serves as a stop for the knife-holding fixture, while an indicating device with a special bracket, a special wheel guard for cupped wheels, a swivel table plate and holding fixtures complete the equipment.

The first operation, that of grinding the edges, is performed with the knives held as shown in Fig. 4. Fixture *A*, which has previously been loaded on a bench by means of a loading block, is placed against the stop on the chuck after the chuck has been set square with the table. Then the knives are ground to size as determined by indicator *B*. This indicator is mounted on a swinging arm having a locking device which holds the indicator out of the way when it is not in use. To grind the other edge of the knives, the fixture is merely turned around and the operation repeated. Knives are ground ten at a time in this operation.

A fixture of the design illustrated in Fig. 6 is used to hold the knives in grinding the sides to a bevel. After this fixture has been placed in position against the stop on the chuck, the chuck is swiveled the amount necessary to produce the

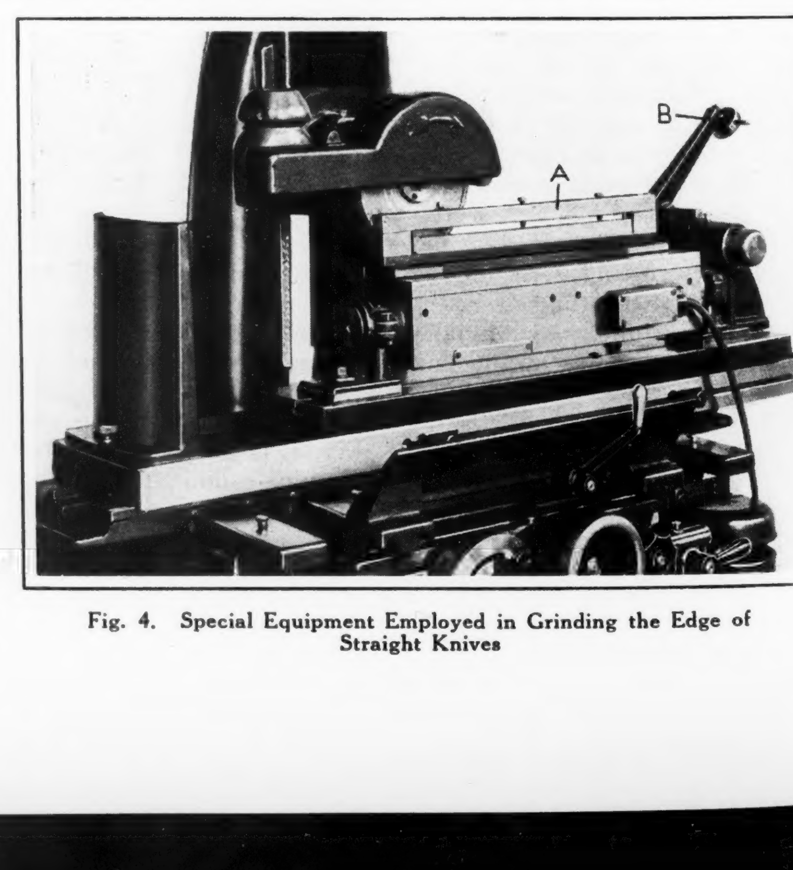


Fig. 4. Special Equipment Employed in Grinding the Edge of Straight Knives

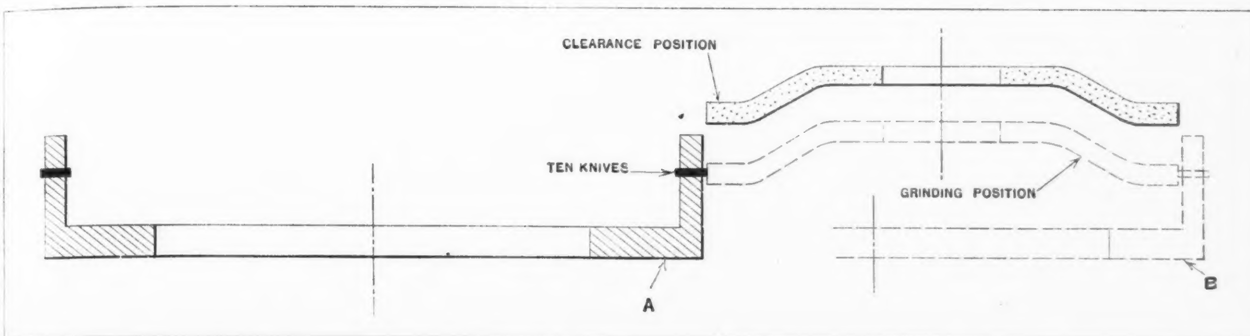


Fig. 5. Diagram Illustrating the Principles Followed in Grinding the Edges of Radial and Helical Knives

desired angle of bevel. Again, the fixture is turned around for grinding the opposite side. One of the completed knives is shown at *A* in this illustration.

Grinding a Bevel on the Knife Ends

Fig. 7 shows equipment provided on the surface grinding machine for grinding a bevel on the ends of straight, helical, and radial knives, one at a time. The knives are clamped in position by means of blocks attached to bars *A* which are forced downward by springs *B* and clamping levers *C*. Adjustable stops govern the length to which the knives are ground. One bevel is ground with the knife in the right-hand fixture of each set, and then the piece is reversed and placed in the opposite fixture for grinding the other bevel. Plate *E* may be swiveled to any desired angle within limits set by the length of the fixtures.

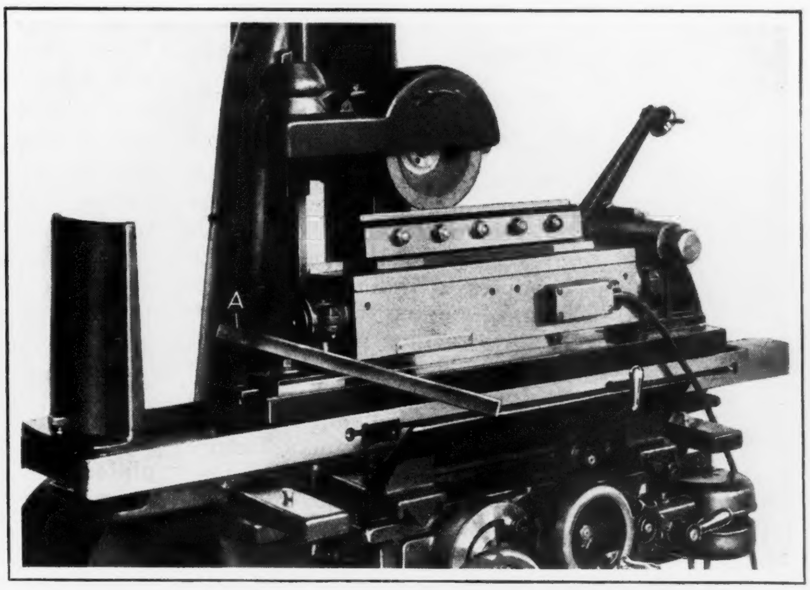


Fig. 6. Grinding a Bevel on a Straight Knife by Using the Same Machine as Shown in Fig. 4

While the equipment here described was designed primarily for the purpose of grinding knives to a high degree of accuracy, a saving of 50 per cent in the cost of finishing the knives has been attained over the methods previously used. In addition, the accuracy of the knives ground by this method reduces the non-productive time of the machine in which

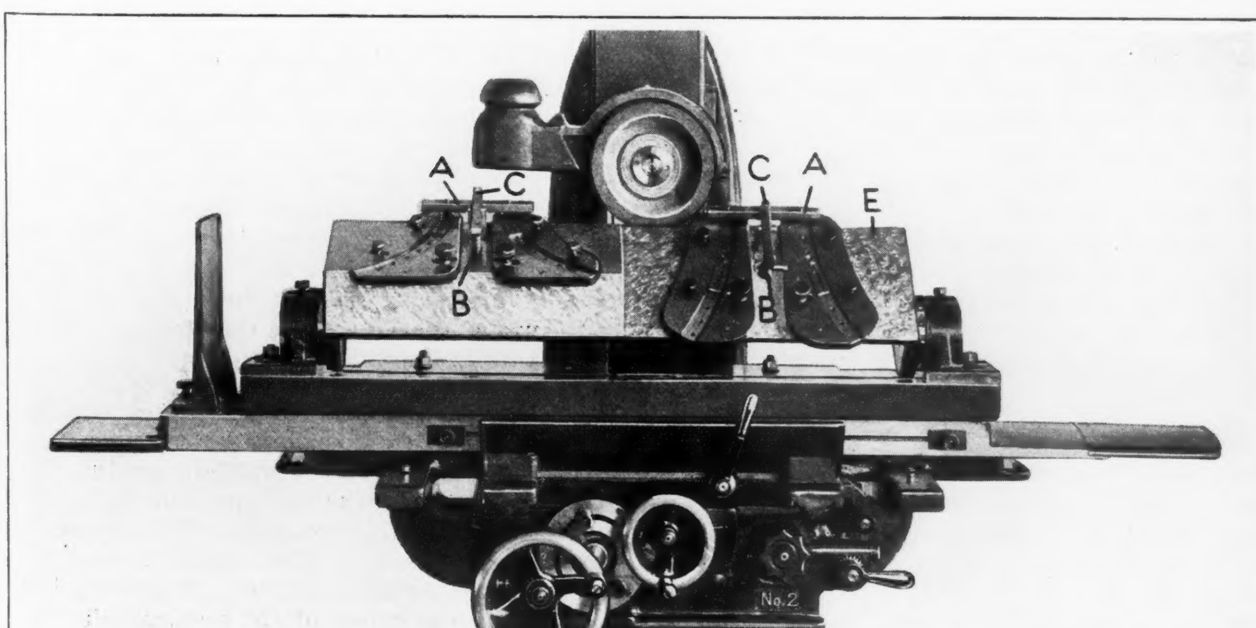


Fig. 7. Special Equipment Employed for Beveling the Ends of All Three Types of Knives

they are used, as fewer adjustments of the knives are necessary.

Considerable experimental work was done to determine the proper grinding wheels to be used for the different knives. It was found that a Norton "Alundum" No. 3860 grade I offset wheel, 12 by 1 3/8 by 3 inches, was best fitted for grinding helical and radial knives, while a No. 3846 grade H cupped wheel, 7 by 2 by 1 1/2 inches, was preferable for straight blades. In grinding the bevels, a No. 3880 grade I cupped wheel, 12 by 1 1/2 by 5 inches, is used.

* * *

THE HYDRAULIC OPERATOR

A new and interesting industrial control device developed by the General Electric Co. was shown at the recent National Machine Tool Exposition in Cleveland. The "hydraulic operator," as it is called, takes the place of large alternating- or direct-current magnets and solenoids and may also be used to replace air cylinders when quiet and smooth upward thrust is desired through a given distance.

The device consists of a motor-driven centrifugal oil-pump, the impeller of which is mounted in a piston and driven by means of a splined shaft. This arrangement enables a stationary mounting to be used for the motor. The normal position is with the piston at the bottom of the cylinder, which is approximately two-thirds filled with oil. When started, the motor drives the impeller, creating a pressure between the bottom of the piston and the bottom of the cylinder. The pressure tends to move the piston upward, and it will travel the full length of the cylinder, providing the load on the ends of the push-rod is not too great.

The device is made in three standard sizes, giving, respectively, 200, 300, and 600 pounds push. The speed of operating is slower than that of a solenoid, but is relatively fast. The motors are from 1/4 to 1/2 horsepower. The device can be applied to brakes, clutches, spot-welders, and other mechanisms where solenoids and air cylinders are now used.

* * *

Not many know that the United States Government maintains a moving picture circulating library. These films, portraying the nation's mining and metallurgical industry, are available for free distribution all over the world to educational institutions, Army and Navy posts, or, in fact, any organization engaged in spreading information of the sort treated in the pictures.

TO SAVE RETAPPING FINISHED PARTS

By ERNEST L. HOLCOMB

In assembling small interchangeable machine parts, extra expense is often caused by screws fitting too tightly to be assembled easily. The remedy usually applied is to retap the threaded holes by machine. This delays production and sometimes injures the threads by crossing them, though it is, of course, quicker than retapping by hand. When the parts have been hardened, the difficulty is increased.

If the tight fit is produced by a finishing process, as, for example, heavy copper or nickel plating, it may be advisable, as a permanent remedy to adopt one of the following methods:

1. Tap the holes approximately 0.001 inch over size with a special tap, so that the finishing process will leave them nearly standard size.

2. Thread the screws approximately 0.001 inch under size, unless they are used in several places on the machine; some places do not require the extra allowance.

3. Tap the holes standard size after applying the finish. This works well in many cases, and there is little danger of rusting in steel or iron, if the screws are plated or otherwise finished. To keep the thread flush with the surface, countersink the holes slightly, on either one or both sides, as required, before applying the finish. With a little practice, this countersinking may be done on the drill press "free hand," instead of setting to a stop. It also takes the place of the usual burring operation.

Japanned parts may often be handled very satisfactorily by the third method, especially sheet-metal parts when the coating is not too heavy. In any case, the preliminary countersinking has a tendency to prevent loosening or chipping of the finish around the holes.

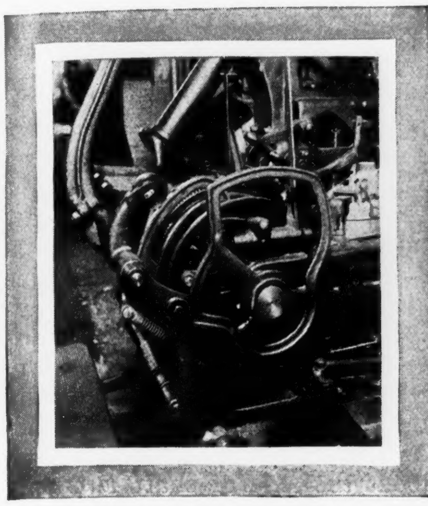
The only way to prove whether any of the methods mentioned should be used is to try it out on a trial lot, and make a report, including an estimate of the probable saving and a notation as to whether the quality is improved.

Gaging Small Interchangeable Work

Gaging and inspection methods are still far from standardized. There are certain well defined methods and processes used in manufacturing the products of industry, but there are many diverging methods for inspecting and gaging these products. An article in December MACHINERY on the development and application of a gaging system especially intended for use in the manufacture of low-priced clocks and watches, will prove of interest to everyone engaged in the manufacture of small mechanisms in general; the methods described are applicable to small parts common to a great variety of products. The article presents a brief outline of the conditions under which the system was developed, and describes in detail the different gaging means that have been adopted.

* * *

The longest arch span of any bridge in the world—a span of 1675 feet—will be the distinguishing feature of the Kill van Kull Bridge linking Staten Island to New Jersey. With approaches, the bridge will have a total length of over 1 1/2 miles and will cost $18,000,000. The central span will have a clear height of 150 feet over the water, and the arch at the center will rise 275 feet above the water level.



Ingenious Mechanical Movements

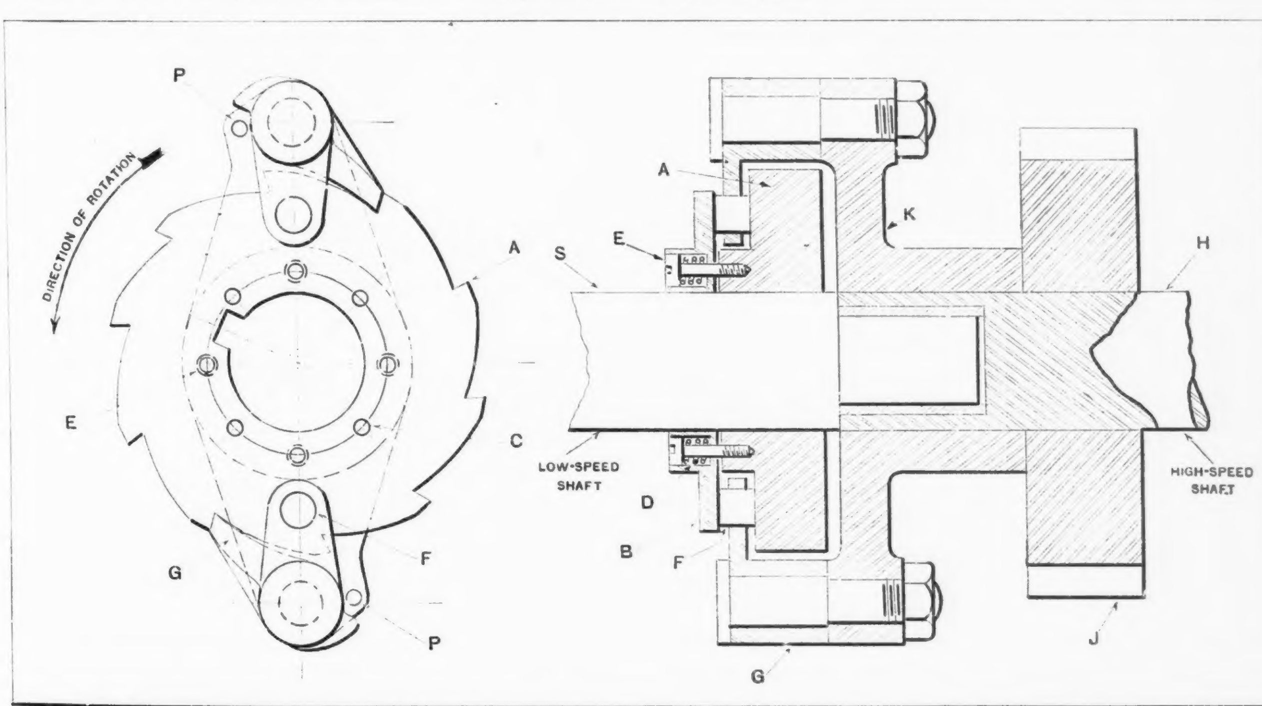
OVER-RUN PAWL CLUTCH

By CHARLES E. ARD

The pawl clutch shown in the accompanying illustration has been used very successfully in machines having camshafts or feed-screws which must be driven at accelerated or high speeds a part of the time. The low-speed shaft *S* drives the high-speed shaft *H* under normal operating conditions through the ratchet wheel *A* and pawls *G* of the collar *K*, which is keyed to the high-speed shaft. When the speed of shaft *H* is to be accelerated, a clutch mechanism, not shown, is engaged, and this drives the high-speed shaft at the accelerated speed through gearing connected with shaft *H* by gear *J*. The arrangement of the over-run clutch is such that it permits shaft *H* to be operated at the higher rate of speed without affecting the speed of shaft *S*.

Referring to the construction of the clutch, ratchet wheel *A* is keyed to shaft *S*. The pressure disk *B* is a sliding fit on shaft *S*, and is driven by ratchet *A* through pins *C*. The tension springs *D* tend to force the pressure disk *B* inward toward the ratchet wheel.

Between disk *B* and the ratchet wheel are fiber drag-plugs *F*, which are set in holes in the ways of the pawls *G*. Behind the pawls are stop-pins *P* which keep the drag-plugs from swinging through too large an arc and thereby becoming entirely disengaged from the disk and the ratchet wheel. When the high-speed clutch is tripped and the gear *J* is driven at a higher speed than the ratchet wheel *A*, the pawls *G* are disengaged, and the plugs *F*, which then drag between the pressure disk and the ratchet wheel, cause the pawls to swing clear of the teeth in the ratchet member. The pawls remain in this disengaged position until the high-speed clutch is disengaged, at which time the drag on the plugs *F* is reversed, causing the pawls to be drawn down into engagement with the teeth and the ratchet wheel again.

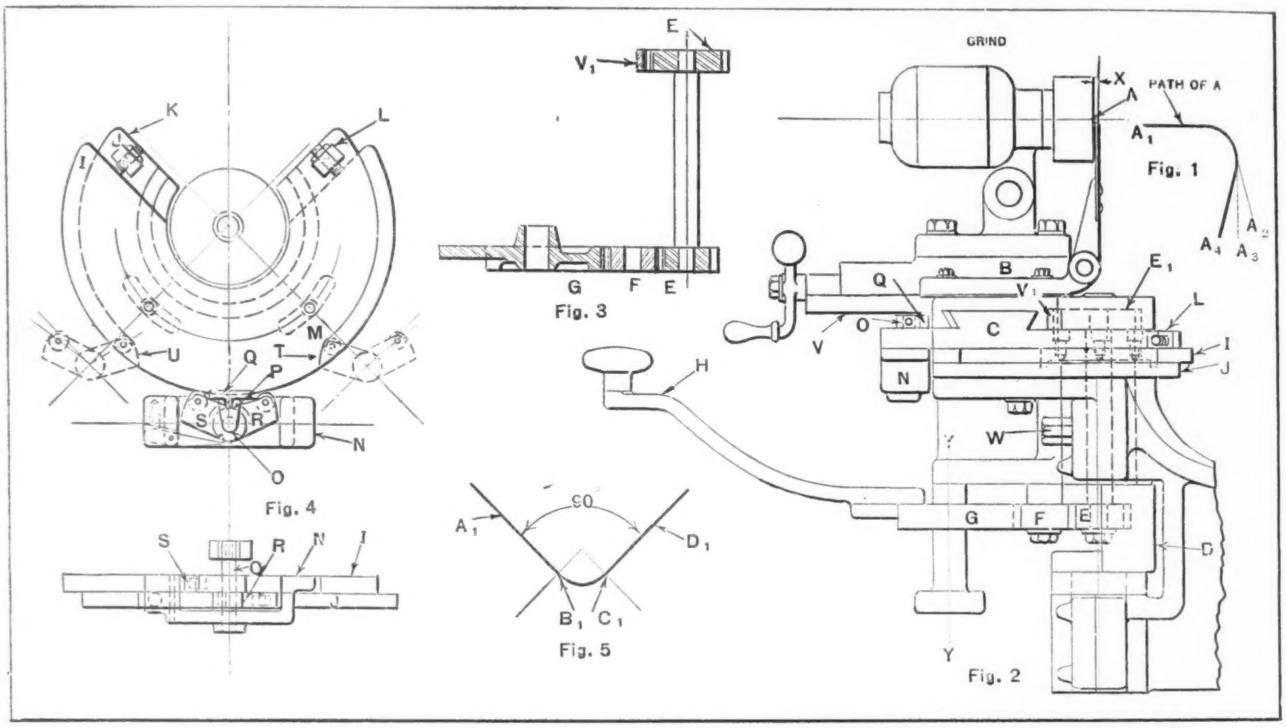


Over-run Clutch which Permits Speed of Driven Shaft to be Accelerated without Affecting Speed of Driving Shaft

CONTOUR GRINDING MACHINE MECHANISM

By E. C. OLIVER, Oliver Instrument Co., Adrian, Mich.

The mechanism shown in Fig. 2 controls the traversing movement of a grinding wheel in such a manner that hardened cutters can be quickly and accurately ground to contours such as are indicated by the three outlines in Fig. 1. By simply moving the handle *H*, Fig. 2, from left to right, the grinding surface of the wheel at *A* will follow a path, such as is indicated in Fig. 5 by the line $A_1B_1C_1D_1$. In this case, the wheel grinds the straight surface from A_1 to B_1, and without pausing forms the radius from B_1 to C_1, continuing to the point D_1, the side C_1D_1 being ground at right angles to side A_1B_1 and the corner formed in one continuous pass.



Figs. 1 to 5. Mechanism of Contour Grinding Machine

By reversing the movement of handle *H*, the wheel is caused to travel back along the same path to the starting point A_1. Provision is made for setting the machine to grind the sides A_1B_1 and C_1D_1 to any included angle from 70 to 110 degrees instead of 90 degrees as shown, and with a radius of curvature at the corner of from 0 to 1 1/2 inches.

During the movement of the grinding wheel from A_1 to B_1, Fig. 5, the handle *H*, Fig. 2, revolves about the center line *Y–Y*, transmitting the required longitudinal movement to carriage *V* which slides on *C*. The gear train that transmits motion from gear *G* to the rack V_1 secured to carriage *V* is shown in Fig. 3. It will be noted that handle *H* is secured to gear *G*, which is actually a segment gear.

When the grinding surface of the wheel reaches point B_1, Fig. 5, the revolving movement of handle *H* about axis *Y–Y* is automatically stopped and continued pressure on the handle causes the carriage *V* and slide *C* to revolve about the vertical axis of shaft *D* until the grinding surface of the wheel reaches the point C_1, when further movement about the axis of shaft *D*, Fig. 2, is stopped, and lever *H* again revolves about axis *Y–Y*, causing the wheel to travel from C_1 to D_1.

The grinding wheel is directly connected to the motor, which is mounted on the cross-slide *B* on carriage *V*. The distance *X* from the center line of shaft *D* to the grinding face of the wheel determines the radius of curvature of the corner. Carriage *V* is fitted to the slide *C*, which is secured to the top surface of shaft *D*. Shaft *D* thus supports the slide *C*, carriage *V*, cross-slide *B*, and the grinding wheel and its driving motor. These parts all swing together about the axis of shaft *D* during the corner-forming portion of the traversing movement.

Underneath slide *C* and fastened to the supporting frame or member are two plates *I* and *J*, also shown in the plan view Fig. 4. These plates have stops *K* and *L* and cut-out portions on their peripheries which terminate in the cam surfaces at *T* and *U*. The spacing between *T* and *L* on plate *I* is definitely fixed, as is also the spacing or relationship of *K* and *U* on plate *J*. These plates are adjustable around the center of shaft *D*, and may be clamped in any desired position. The angle between *T* and *U* determines the angle of rotation of shaft *D* and slide *C* in forming the corner, and consequently, the included angle between the sides of the piece ground.

Midway of the length of slide *C* and in line with the center of the shaft *D* is a vertical shaft *O*, Fig. 4, supported by bearings on slides *C* and *N*, Fig. 2. On the upper end of shaft *O* is a two-tooth

segment of a gear which meshes with a single rack tooth Q, attached to the mid point of the front face of carriage V. Also fixed to shaft O, Fig. 4, are two arms S and R, provided with rollers which make contact with the peripheries of plates J and I. The arms are offset vertically, so that S is in line with plate I, and R in line with plate J.

The plan view in Fig. 4 shows the relative positions of the parts at the middle point of the corner-forming portion of the traverse movement. At this stage of the traverse movement of the grinding wheel, the shaft D is free to rotate in its bearings, and a movement of handle H to the right causes slide C and all parts attached to it to swing to the right about the vertical axis of shaft D. With the tooth Q in mesh with the two teeth of segment P, as shown in Fig. 4, and the roller in arm S in contact with the periphery of plate I, movement of carriage V along slide C is positively prevented.

Rotation of slide C will continue until arm S drops into the cut away portion T, at which point slide C makes contact with stop L and further rotation about the axis of shaft D is positively prevented. When the roller of arm S drops into T and the parts are locked by stop L against further rotation about the axis of shaft D, the tooth Q is released from contact with the locking teeth of segment P by the rotation of shaft O. This leaves the carriage V free to slide on member C, so that resumption of the turning movement of handle H about axis Y–Y will complete the grinding movement along line C_1D_1, Fig. 5.

When the movement of handle H is reversed, carriage V will slide along C until tooth Q enters the space between the two teeth of the segment P on shaft O. The continued motion of V and, consequently, the rotation of shaft O, causes the arms S and R to rotate until the roller in S is free of the opening T and the roller in arm R is in contact with the periphery of plate J.

When R makes contact with J, further motion of V on C is prevented, but rotation of C about D is permitted until R enters U and C makes contact with stop K, thus completing the corner-forming movement from C_1 to B_1, Fig. 5. The carriage V can now slide on C and the revolving movement of handle H to the left about axis Y–Y completes the movement of the wheel from B_1 to A_1.

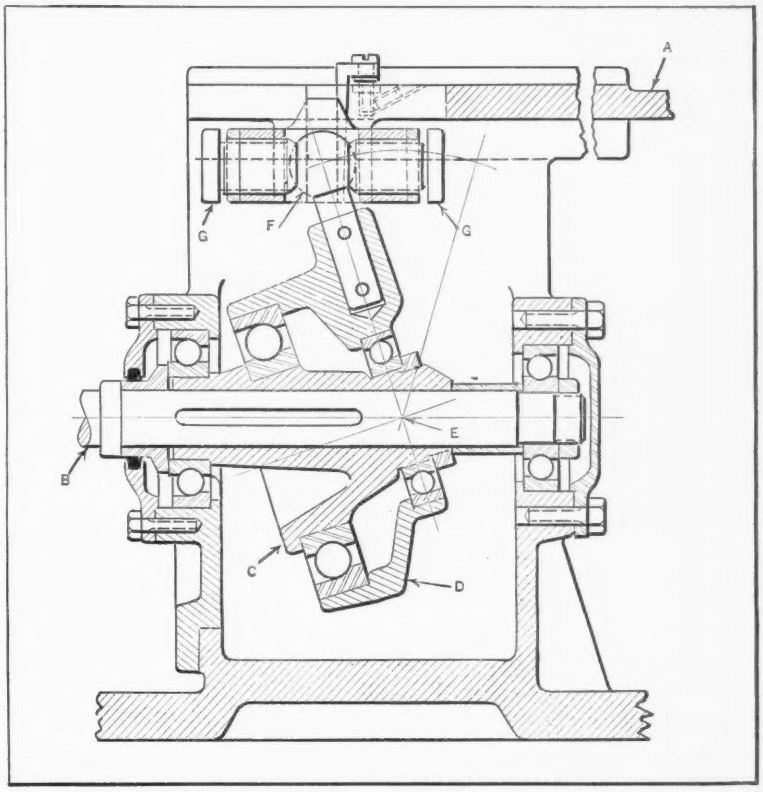
When the rotating movement required in forming the corner to a radius is taking place, all parts of the mechanism are locked against relative movement with each other, and the motion of handle H acting on gear E through gears G and F causes the complete assembly to revolve about the axis of shaft D. The combination of movements is caused by the continuous movement of H. There is no hesitation in the movement at the corners when rotation starts or stops, and no lost motion in the locking and unlocking action of the mechanism.

MECHANISM FOR RECIPROCATING SLIDE PARALLEL TO DRIVING SHAFT

By J. E. FENNO

In a special high-speed machine used to shear and form fiber shields for electrical switches, it was required that slide A (see illustration) have a reciprocating motion parallel to driving shaft B. It was also essential to operate slide A without lost motion due to wear, and the design here shown has proved satisfactory in this respect.

The reciprocating motion is obtained from an angular eccentric sleeve C, secured to driving shaft B. As this sleeve revolves, it imparts a swinging motion to part D about center E. This motion is transmitted to slide A through a rod which is fixed to D and has a ball-shaped end F. The spherical end engages concave seats in bronze screws G, held in a cross-head that is free to slide vertically far enough to provide for the rise and fall resulting from the circular movement of ball F. Screws G provide adjustment to eliminate play, and the vertical cross-head slide has adjustable gibs.



Reciprocating Mechanism of a High-speed Machine for Operating Slide Parallel to Driving Shaft

The two ball bearings that support the driving shaft and also the two between sleeve C and part D are of the combination radial and thrust type. The mechanism is enclosed in a bracket cast integral with the machine proper and forming a well so that the lower members are always in a bath of oil. This reciprocating mechanism operates smoothly and accurately, and requires little attention other than to add oil to the well at intervals of approximately two months.

Current Editorial Comment

In the Machine-building and Kindred Industries

THE GREAT MACHINE TOOL EXPOSITION

It is difficult to estimate the educational value of the exposition of machine tools and shop accessories held in Cleveland last month. There, shop executives from all parts of this country and many foreign ones, responsible for production in every machine-building and metal-working field, had an opportunity to learn more in a few days about recent advances in machine shop practice than would have been possible during weeks of travel, visiting manufacturers and users of machine tools. No mechanically minded man could leave the exposition without having gathered a fund of knowledge about new equipment and new methods seen in operation at Cleveland, and many ideas acquired therefrom will soon "be put into effect" in hundreds of plants throughout this country and others.

The exposition was 40 per cent larger in booth area than the 1927 show, and there were 30 per cent more exhibitors. The number of mechanical executives and engineers visiting the show was 80 per cent greater than at the previous exposition. From every point of view, it was the most successful and the most impressive machine tool exhibition that has ever been held, either in this country or abroad.

An enumeration of hundreds of new machines, devices and tools that were exhibited; or even an effort to describe the outstanding new developments shown, would fall far short of the effect produced by the appliances themselves. It may be truly said that the Machine Tool Exposition of 1929 set a mark that it will be difficult to pass.

* * *

IMPROVING TOOL KITS FOR SERVICE WORK

If careful attention is given to the selection of the tools required in a demonstrator's or service man's tool kit, its weight can often be reduced considerably. Demonstrators and service men who must carry heavy tool kits with them from place to place, will appreciate having their tool kits looked over carefully, with a view not only to reducing the weight, but also to seeing that all the appliances necessary to facilitate the work in the customer's shop are provided.

One company whose product requires the employment of a large number of service men throughout the country, found on checking up the various tools in their kits that it was possible to reduce the weight by one-third and to decrease materially the size of the tool-kit bag. This was done by combining certain tools, redesigning others and removing excess weight wherever practicable. By giving careful attention to the purposes for which the tools were intended, it was also possible to include appliances to meet most conditions, thereby eliminating to a great extent the necessity of borrowing tools on the job.

It is well worth while studying the tool kits of demonstrators and service men. The men will thus be given an opportunity to use their time to better advantage than in hunting for tools they should have; and their energy will be preserved for better purposes than carrying around unnecessarily heavy tool kits.

* * *

DESIGNING TOOLS AT THE BENCH

In the earlier days of the use of jigs and fixtures, it was common practice to have the toolmaker first design a fixture and then go ahead and build it. Later, it was considered better practice to employ draftsmen—usually known as tool designers—to design the jigs and fixtures, making a complete drawing to which the toolmaker would work.

Recently some shops have returned to the older method and let the toolmakers design tools at the bench, but this practice is not in keeping with modern efficient practice. A tool designer who devotes all of his time to devising ways and means for holding work in jigs and fixtures and who has acquired long experience in the solution of many different machining problems, is more likely to be able to design satisfactory tooling equipment than the toolmaker working at the bench, whose experience is limited largely to the fixtures that he actually builds.

There is little if any time saved by the old method, because the toolmaker must spend some time thinking out the design just the same as the draftsman would; and a carefully made drawing often saves a great deal of expense because of the mistakes it prevents. The toolmaker who works to rough sketches that he has made himself, often is obliged to use "cut-and-try" methods that may prove costly.

In general, therefore, it is better practice to have all tools designed in the drafting-room, giving the toolmakers carefully worked-out, clear and distinct drawings from which to work. While it is true that there are some differences of opinion on this subject, these are due largely to special and unusual conditions that may exist in certain shops. No rule could be applicable in every instance, but as a general principle, manufacturers have found the methods outlined to be the most satisfactory and efficient.

The American Machine Tool Industry

An Analysis of the Production of Machine Tools in the United States, Based on Statistics Published by the Bureau of Census

According to the latest census of machine tools—that covering production in 1927—the total value of the machine tools manufactured in the United States amounted to over $107,000,000. Metal-working machines other than machine tools were manufactured to a value of over $39,000,000. Under this heading come rolling mill machinery, sheet-metal working machinery, wire drawing machinery, and similar equipment.

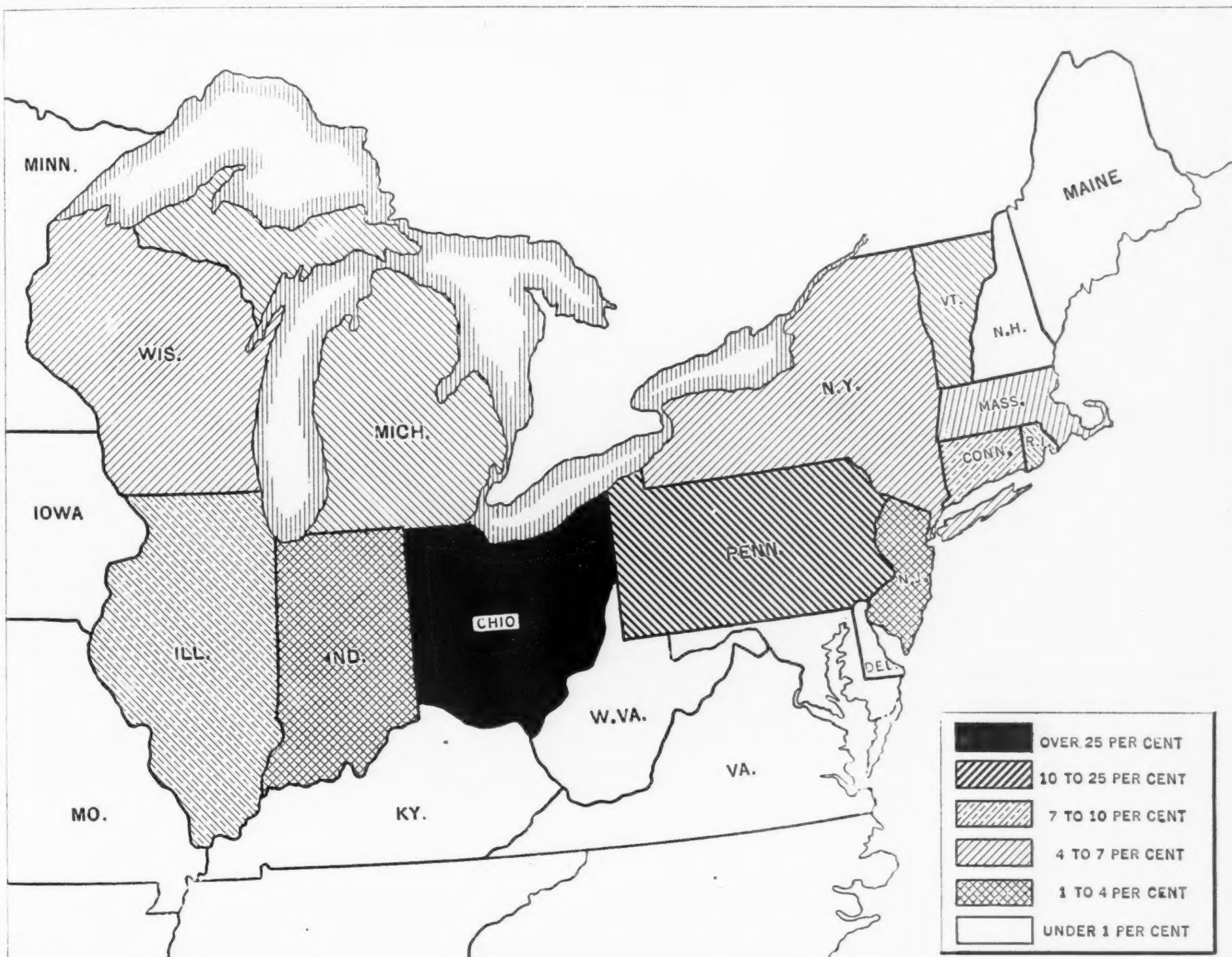


Diagram Showing Production of Machine Tools in the United States in 1927, and the Percentage Built in Each State

Comparative Statistics of the Machine Tool Industry

It may be of interest to trace briefly the development of the machine tool industry during the last thirty years and to note which states lead in the production of machine tools. There are no statistics available to show either the number of machine tool plants in existence or the value of the product manufactured previous to 1899. By that time the Ohio machine tool industry had become well established, and it is of interest to note that the proportion between the machine tool production in New England and that of Ohio, while slightly fluctuating, has not changed to a great degree in the last thirty years. The relative importance of the states of New York, New Jersey, and Pennsylvania as machine tool building states, however, has decreased, while the importance of Illinois, Indiana, Michigan, and Wisconsin has increased.

The statistics for 1899 do not show separately for each state the value of the machine tools built, but include all metal-working machinery. In that year we find that the New England states were responsible for 32 per cent of the total output; Ohio for 30 per cent; New York, New Jersey, and Pennsylvania for 26 per cent; and Illinois, Indiana, Michigan, and Wisconsin for practically the entire remainder—12 per cent.

In 1904, the next year for which statistics are available, there was a temporary depression in the machine tool industry which affected the Ohio manufacturers more than those in New England. In that year we find the output of the New England states

Table 1. Production of Machine Tools in 1927 (Bureau of Census)

Kind of Machine and State	Number of Machines	Value, Dollars
Bending machines	439	368,643
Illinois and Indiana	318	162,953
Ohio and Pennsylvania	69	146,127
All other states	52	59,563
Boring machines	598	3,352,394
Horizontal	303	1,675,719
Illinois	81	294,297
Ohio	117	560,114
Pennsylvania	20	186,113
All other states	85	635,195
Vertical	295	1,676,675
Illinois	91	319,970
Ohio and Pennsylvania	99	806,715
All other states	105	549,990
Broaching machines	255	371,827
Cutting-off machines	2,056	602,434
Rotary-cutter type	132	259,727
Hacksaw type	1,924	342,707
Drilling machines	6,891	7,744,796
Single and multiple-spindle (upright)	2,849	4,730,531
Illinois	906	744,978
Ohio	1,348	2,339,375
All other states	595	1,646,178
Radial	509	1,495,437
Ohio	452	1,388,488
All other states	57	106,949
Sensitive	3,533	1,518,828
Forging machines	738	2,481,357
Bolt, nut and rivet		
Connecticut, Michigan, and Ohio	663	1,829,707
Bulldozers and others		
Illinois, Ohio, and Wisconsin	75	651,650
Gear-cutting machines	1,267	4,416,656
Formed rotary cutter type	128	368,742
New Jersey	70	227,688
All other states	58	141,054
Hobbing, and other types	1,139	4,047,914
Grinding machines	5,965	12,250,201
Cylindrical	1,425	3,657,574
Plain	1,017	2,942,504
Universal	408	715,070
Surface	786	1,550,857
Massachusetts and Rhode Island	674	1,211,940
All other states	112	338,917
Cutter, drill and tool	1,723	908,473
Conn., Mass., Rhode Island,	367	346,879
Ohio and Pennsylvania	1,068	290,386
All other states	288	271,208
Internal	932	2,893,307
Other types	1,099	3,239,990
Hammers (stationary)	324	560,459
Steam, air and drop		
New Jersey, Ohio, Pennsylvania, Rhode Island	208	405,797
Power (belt or motor) and others		
Illinois, New York, Ohio, Pennsylvania, and Wisconsin	116	154,662
Lathes	11,067	18,749,746
Engine	6,660	6,407,401
New York	383	235,882
Ohio	2,132	3,637,849
All other states	4,145	2,533,670
Bench	1,215	244,035
Massachusetts	416	147,739
All other states	799	96,296
Turret (including hand screw machines)	1,776	5,146,423
Connecticut, Rhode Island, and Vermont	502	1,641,390
Indiana, Ohio, and Wisconsin	1,274	3,505,033
Other types	1,416	6,951,887

Kind of Machine and State	Number of Machines	Value, Dollars
Planers	196	1,867,449
Ohio	137	1,237,892
All other states	59	629,557
Milling machines	2,978	8,545,125
Hand feed	252	77,432
Power feed	2,726	8,467,693
Plain	945	2,214,037
Universal	713	1,675,165
Vertical	319	779,647
Lincoln	421	1,063,713
Planer and other types	328	2,735,131
Pipe-cutting and threading machines	2,281	1,344,145
Portable tools	.....	16,801,574
Drills	.....	
Electric	.....	3,742,643
Ohio	.....	1,443,234
Connecticut, Illinois, Kentucky, Maryland, New York, and Pennsylvania	.....	2,299,409
Pneumatic		
Illinois, Michigan, and Ohio	11,627	1,108,839
Hammers, pneumatic (chipping, riveting, calking, etc.)		
Illinois, Maryland, Michigan, and Ohio	30,513	3,467,486
Grinders, electric	.....	3,207,697
Maryland and Ohio	.....	1,599,305
Michigan and Wisconsin	.....	659,567
All other states	.....	948,825
Other types and those not distributed as to class	.....	5,274,909
Presses, hydraulic and other power, for bending, forming, stamping and forging	.....	8,770,001
New Jersey and New York	.....	1,236,994
Ohio and Pennsylvania	.....	5,940,145
All other states	.....	1,592,862
Punching machines (not portable)	638	862,118
Illinois and Indiana	286	222,386
Ohio	112	182,119
Wisconsin	121	91,768
All other states	119	365,845
Riveting machines (not portable)	1,368	673,307
Connecticut, Illinois, and New York	1,327	632,170
All other states	41	41,137
Screw machines (automatic)	1,810	5,208,702
Multiple- and single-spindle		
Connecticut, Rhode Island, and Vermont	1,566	4,511,140
All other states	244	697,562
Shapers	986	1,628,775
Connecticut	161	324,939
Ohio	539	816,640
All other states	286	487,196
Shears (power)	1,771	1,308,169
Illinois	132	104,052
Indiana and Iowa	840	270,218
New Jersey, New York, and Pennsylvania	382	376,826
Ohio	258	365,020
All other states	159	192,053
Slotters	36	182,154
Threading machines (except for pipe)	651	1,028,386
Die type	538	546,209
Milling type	113	482,177
Tapping machines	484	584,730
All other machine tools	.....	7,398,504

Machinery

equal to 35 per cent of the total; Ohio, 25 per cent; New York, New Jersey, and Pennsylvania, 24 per cent; while that of Illinois, Indiana, Michigan, and Wisconsin increased to about 16 per cent.

The next census of the machine tool industry was taken in 1914. Again we find the output of New England equal to 35 per cent of the total; Ohio, 29 per cent; New York, New Jersey and Pennsylvania, 18 per cent; while Illinois, Indiana, Michigan, and Wisconsin increased their share to 18 per cent.

In 1925, we find a slight reduction in the relative output of New England, which in that year equalled not quite 30 per cent; the share of Ohio remained about the same, or 28 per cent; Pennsylvania, New York, and New Jersey produced 21 per cent; and the four states west of Ohio, listed above, slightly over 20 per cent, the remainder being scattered between a number of states.

Machine Tool Manufacture According to the Latest Census

In the last census figures available—those for 1927—we find that New England produced approximately 30 per cent of the total; Ohio, 29 per cent; New York, New Jersey, and Pennsylvania, 17.5 per cent; and Illinois, Indiana, Michigan, and Wisconsin, 22 per cent. Table 2 gives the production of the leading machine tool building states. The totals for the different states have been given separately in all cases where the figures could be published without disclosing the operations of individual plants. It will be noticed that Rhode Island is missing from the enumerated states and is included under the total "All Other States" at the end of the table, because one plant in that state is very much larger than all the others put together. From past statistics it is possible to deduce quite accurately, however, that the production of machine tools in Rhode Island is somewhat over 8 per cent of the total produced in the United States.

Location of the Center of the Machine Tool Industry

It might be of interest to attempt to locate the center of the machine tool industry in the United States in the same way as the center of population is located. It will be found that this center is located approximately on a line passing north and south just east of Cleveland, Ohio. Very nearly one-half the machine tools produced in the United States are built in New England, New York, New Jersey, Maryland, Delaware, and Pennsylvania, while slightly more than one-half are built in Ohio and the states west of Ohio.

Table 2. Production of the Machine Tool Industry in the United States
(Based upon the Census of Manufactures for 1927—Total Value of Machine Tools Produced, $107,101,652)

State	Value of Product	Per Cent	State	Value of Product	Per Cent	State	Value of Product	Per Cent
Ohio	31,288,174	29.2	Massachusetts	7,294,239	6.8	Vermont	5,043,526	4.7
Pennsylvania	11,006,943	10.3	Michigan	5,820,369	5.4	Indiana	2,938,212	2.8
Connecticut	10,350,360	9.6	New York	5,749,479	5.4	New Jersey	1,882,963	1.8
Illinois	9,529,608	8.9	Wisconsin	5,057,499	4.7	All other states	11,140,280	10.4

Machinery

TRAINING AIRCRAFT WELDERS

"In training welders, we have found it cheaper and better to start with a green man than to break an experienced welder into aircraft work," said Richard M. Mock, aeronautical engineer, Bellanca Aircraft Corporation, in a paper on "Welding in Aircraft Construction" presented at a recent meeting of the Society of Automotive Engineers. The reason for this is that a man experienced in welding heavier material must first learn to overcome his natural tendency to employ methods that he has found to be necessary in handling the general run of welding work, but that are entirely unsuitable for aircraft work.

The apprentice welder in the Bellanca factory spends his first few weeks at the bench welding scrap. He is next given such work as tacking secondary structural parts, which include fairing strips, cowl supports, and pulley housings. He is always under the supervision of an experienced welder. After about six weeks of such tacking, he starts tacking fittings and parts of secondary importance.

In another six months he is welding most of the primary structure, and about three months later is usually qualified for any type of welding. The welders undergo tests about every two weeks that tend to make them more careful in their work.

* * *

MEETING OF SCREW MACHINE PRODUCTS ASSOCIATION

The Screw Machine Products Association met at the Hotel Hollenden, Cleveland, Ohio, Tuesday, October 1. Standard cost classification and cost estimates were outlined, and these important subjects were thoroughly discussed. Other subjects, such as a monthly business barometer, credit exchange, and standard conditions of sale were explained and discussed. At the meeting there was available a special report based on a survey covering the hours of work, night shifts, rates and methods of pay, and number of machines per operator. The field secretary of the Screw Machine Products Association is Malcolm Baird, 232 Delaware Ave., Buffalo, N. Y.

* * *

A new racing car with two engines of 4000 horsepower, having twenty-four cylinders, is being built at Wolverhampton, England. The builders claim that it will be capable of a speed of from 280 to 300 miles an hour.

Crankshafts Turned in Two Operations

Methods Used in Completely Turning and Facing Four-cylinder Automobile Crankshafts with Two Machines

ALL the bearings, crankpins, and other finished surfaces of the crankshafts used in the Plymouth automobiles built by the Chrysler Corporation, Detroit, Mich., are turned complete in two operations. As may be seen in Fig. 3, this crankshaft has four crankpins and three main bearings. In the first operation, which is performed in the Le Blond center-drive automatic crankshaft lathe shown in Fig. 1, all three bearings are turned to the rough grinding size and their adjacent crank cheeks faced, and the various surfaces at both the flywheel and stub ends are also turned and faced. This operation completes the turning of the part, with the exception of the crankpins, to the outline shown in Fig. 3.

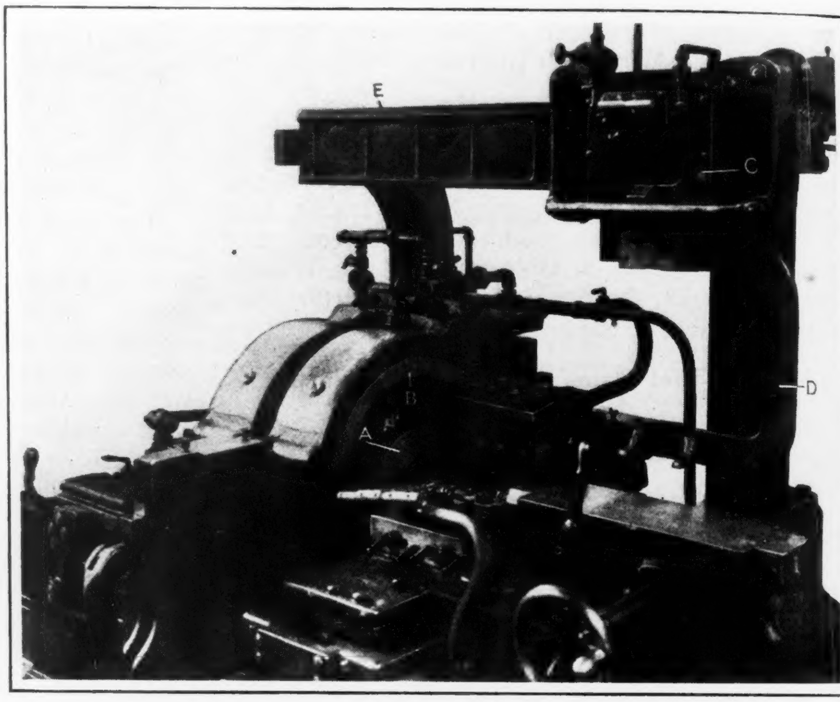


Fig. 1. Automatic Center-drive Lathe in which the Main Bearings and the Flywheel and Stub Ends of Crankshafts are Turned and Faced

The cuts on the cylindrical surfaces are taken by tools mounted on three slides at the front of the bed, while all facing cuts are performed by tools held on three slides at the rear. The right-hand front slide has a backward movement to feed the five cutters to depth, and then travels along the crankshaft to turn the rear main bearing and the several surfaces of the stub end. Both the left-hand front slide, which turns the flywheel end and the front main bearing, and the middle slide, which turns the middle main bearing, simply feed toward the work. The tools on the left-hand and middle front slides have a width corresponding to the length of the surfaces turned. The three slides at the back of the bed simply feed forward for taking the various facing cuts. Cams control the operation of all slides. The tools are given a quick approach to the work, a slow feed, and a fast return.

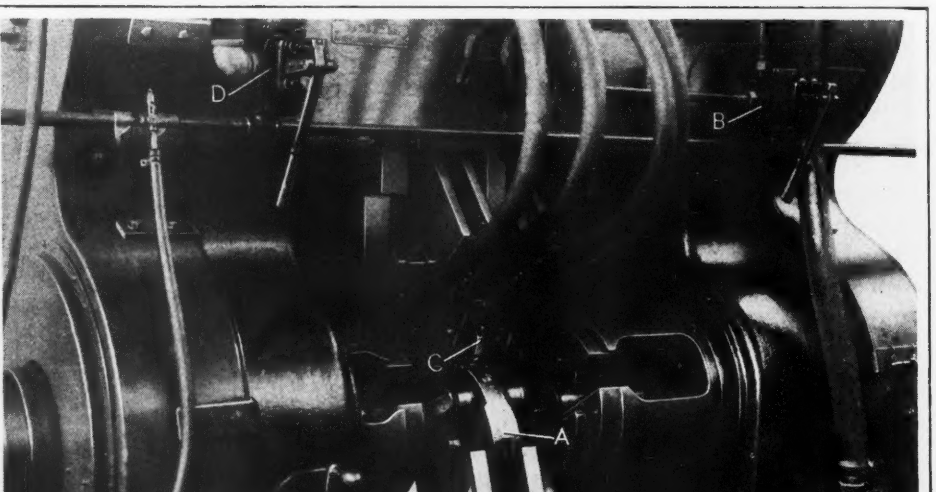


Fig. 2. Turning and Facing All Four Crankpins at One Time to Complete the Turning in Two Operations

How the Crankshafts are Held and Driven

For the operation, the crankshaft is supported on a ball-bearing live center at the headstock end and on a stationary center at the tailstock end. Each outer crank-arm is clamped between a fixed and a hinged jaw such as seen at *A*, Fig. 1, the jaws gripping lugs straddle-milled

in a previous operation, to provide fairly accurate surfaces for this purpose. Hardened blocks in the jaws come in contact with these milled lugs. Both pairs of jaws are attached to a large ring gear such as seen at *B*. The two ring gears run in heavy bearings, as shown, and are driven by pinions on a shaft at the rear of the machine. The center tool-slides operate between the gears.

Air Hoists Facilitate Loading the Machines

Six machines of this type give a production of 800 crankshafts per nine-hour day. The parts are carried to the group of machines by an overhead conveyor which extends the entire length of the crankshaft department. At intervals of several feet there are hooks on which the crankshafts are hung.

Manual labor in loading the machines is practically eliminated by the provision of air hoists such as seen at *C*, with which each machine is equipped. These hoists have an arm *D* that can be lowered and swung forward under a crankshaft in the machine to lift the part quickly out of the machine by reversing the air pressure in the hoist. The hoist may be moved along track *E* for loading or unloading.

Turning Four Crankpins at One Time

All four crankpins are turned simultaneously and adjacent shoulders faced in Le Blond automatic pin-turning machines provided with the chucking arrangement and tooling shown in Fig. 2. A description of this type of machine appeared in January, 1929, MACHINERY, page 384. Four machines give an output of approximately one thousand crankshafts per nine-hour day.

When the crankshafts reach these pin-turning machines, the three main bearings have been rough-ground and the crankshaft is located from the flywheel main bearing for length. In loading a crankshaft, hinged clamp *A* is swung over the center main bearing and then air valve *B* is turned on to pull lever *C* down on the head of an adjustable screw fitted in the hinged clamp. Thus, the clamp is held firmly on the work by air pressure. Jaws in the two heavy pot chucks are closed on the end main bearings by turning the handle of air valve *D*. The work is driven by milled lugs on the sides of the two end crank-arms, previously referred to, coming in contact with hardened blocks on the chucks.

Four wide-face tools at the front of the machine turn the crankpins, while eight narrow tools on four holders at the rear face the various shoulders. The tool-blocks are made to follow the rotation of the crankpins by two master crankshafts within the machine.

Approximately 1/8 inch of stock is removed from all surfaces in both the first and second operations. These crankshafts are made from S.A.E. No. 1040 carbon manganese steel.

* * *

MAKING ADVANTAGEOUS USE OF THE MACHINE TOOL EXPOSITION

It is of interest to note that the machine tool builders themselves recognized the very great importance to their own plant executives of the machine tool show recently held in Cleveland. The Pratt & Whitney Co., of Hartford, Conn., for example, sent fifty-two of its shop executives, engineers, and foremen to Cleveland for a two-day visit to the exposition, so that these men could study at first hand the latest developments in machine tools, metal-cutting tools, and gages. Two Pullman cars were engaged to take the party directly from Hartford to Cleveland, where the cars were placed on a siding and used as living quarters during the visit to the show. The party also visited the plant of the Warner & Swasey Co. while in Cleveland.

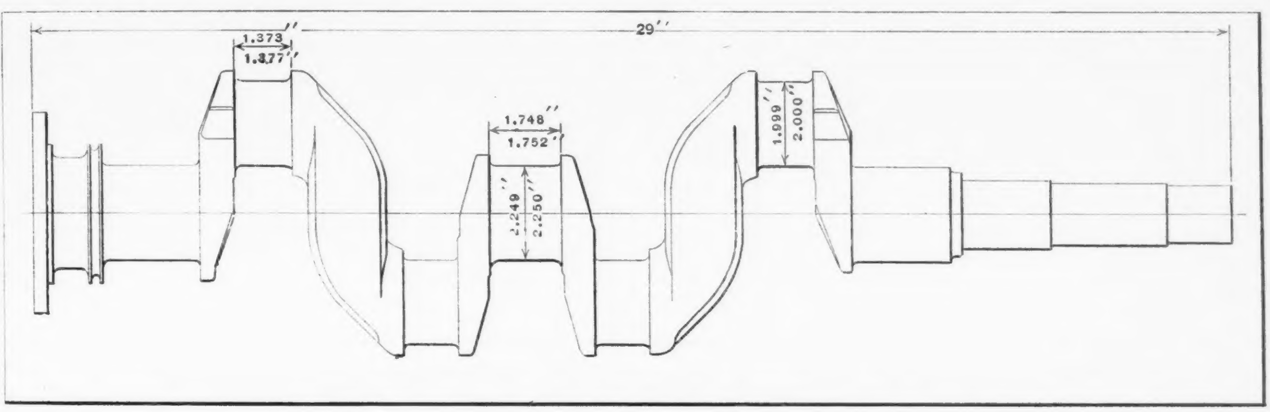


Fig. 3. Diagrammatic View of the Crankshaft Used in Plymouth Automobiles

* * *

SALVAGING SCRAP

The problem of salvaging scrap is solved by the Hoyt Electrical Works of Penacook, N. H., in a very simple manner. According to *Factory and Industrial Management*, the raw brass scrap from the press department in this plant is sorted into bins by the stock-room clerk. Drawings are made which carry the necessary information about the scrap available. When an order comes through for certain parts, these drawings are referred to, and if a certain kind of scrap can be used, it is specified on the order.

What MACHINERY'S Readers Think

A Department for the Interchange of Ideas on Problems of Management, Foremanship, and Employe Relations

PHOTOGRAPHIC SHOP RECORDS

Contractors for all sorts of construction work make it a practice to take photographs daily or weekly as a record of progress. A few machine-building concerns have followed a similar practice and have found it valuable as a matter of record and as a guide in future work. One concern photographs unusually large or intricate castings as they come out of the sand, to show how they were gated. This practice produces an indisputable record, and is of help when the next unusual job comes along.

Machine builders could well adopt this practice, both in the machining and in the erection departments, since photographs of this kind are of great value in recalling forgotten phases of work done in the past that would be of value on new jobs. Possible customers also, are impressed by photographs of this kind, as it shows them how the shop handles work in progress. J. GURWITCH

ENCOURAGING EXECUTIVE ABILITY

If a concern is lacking in men who definitely exhibit executive ability, the management should endeavor to determine who among the employes possess qualifications for leadership and encourage their development. Otherwise, the company must sooner or later face the problem of obtaining executives from outside sources. If there are men in the organization who show initiative and originality in carrying out their daily tasks, they should be given every opportunity to fit themselves for executive positions.

It is best, in most cases, to test a man's executive ability without giving him a definite title, so that he need not know that he is being tried out as a candidate for an executive position until the management is convinced that he will make good on the job. The management should carefully encourage capable men to better themselves, and aid the workers who show ability to perform work requiring initiative, knowledge, and ability, so that potential executive material will always be available.

HARRY KAUFMAN

RATE OF PAY FOR TEMPORARY WORK

In the writer's opinion, capable men who are employed temporarily should be paid a higher rate than the regular employes. It is difficult to find good men for temporary jobs even when higher wages are offered for such work. A company in need of skilled men for a short period of time can generally obtain all the "floating" mechanics required, but it cannot expect a skilled man to take a job that is likely to last but a short time, unless it pays him higher wages.

It is not fair to promise a man a steady job, if the job is only temporary. The foreman should keep this fact in mind. When he has his car repaired by a good mechanic, he pays probably $2 an hour for the job, but if he could keep the same man busy all day, he could very likely obtain his services for 75 cents an hour.

The permanent workers, who seem to object to having temporary men paid a higher rate, should realize that their own rate is the normal one, and that the special rate is a bonus. The regular employes know that they can retain their jobs as long as they like if they do the work efficiently, and they should not object if the company pays a good man special wages for temporary work.

GEORGE H. GUNN

CHANGES IN ADVERTISING METHODS

In the last thirty years advertising methods have changed as much as designs of machine tools and shop methods. If anything, advertising methods have changed even more than the tools and devices advertised. To be convinced of this, all that is necessary is to compare the advertising pages of MACHINERY thirty years ago with those of today.

In the old advertising pages, the reader finds little or no engineering information. Instead of the full pages and double pages in which the advertiser of today tells his prospective customers of the actual performance of his machines or tools, the advertiser thirty years ago was satisfied to share a page with a dozen or more manufacturers. Practically all his advertisement did was to show a small wood cut of the product advertised, list the names of his products, if he didn't specialize in a single line, which very few did at that time, and state the name and address of this firm.

Illustrations of machines in action were never shown, and nobody thought of calling attention to performance records in advertisements. Features of design of the different machines and tools illustrated were seldom brought out. Stereotyped phrases were used, and statements made that might apply to any machine. In other words, there was little individuality in advertising.

Today, the advertising pages are practically everything that the advertising of thirty years ago was not. It would be idle to try to estimate the influence that this new publicity has had in the remarkable development that has taken place in machine tool design, but it is certain that the stimulus provided by good advertising has had a great deal

to do with the constant improvements that have been made.

The writer also finds it of interest to dwell a moment on the development that has taken place in the entire machine tool, small tool, and shop accessories industry simultaneously with this development in advertising methods. Thirty years ago, this industrial field had but a few well-known names of manufacturers of international fame. Today, the number of manufacturers in this branch of the metal-working industry that are known all over the world forms a long list; and where at that time there were only a few really large firms, there are today scores of large and important plants. We need have no misgivings about the future of an industry that has shown such a remarkable capacity for development in the last three decades.

OBSERVER

CHEAP DRAWINGS MAY BE EXPENSIVE

On page 918 of August MACHINERY, there appeared a brief article on drawings. While I do not wish to disagree with the author directly, I feel that sketchy drawings, without checking, are not necessarily expensive, except in cases when they are incorrectly applied to a production job.

To make sketchy, unchecked drawings, and then order the design directly into production is, of course, very likely to establish the fact that cheap drawings are expensive. On the other hand, to make complete production drawings of every experimental design at the beginning is also likely to prove very expensive. In such a case, if the first experimental attempt is not 100 per cent effective, further expenditures may be deemed inadvisable, while with sketchy drawings, two or three tentative designs may be evolved for the price of one, and a real solution found.

There is one compromise that is eminently satisfactory—that is, to use sketchy drawings, but to build a "dog job" first, as a practical check on the success of the design and the correctness of the drawings. If this proves successful, a few drawing corrections and additions, and patterns, templets, etc., will put the job into production without excessive drawing costs or production waste.

FRANK KAHN

REDUCING LABOR TURNOVER

The scarcity of shop-trained men makes the problem of reducing labor turnover one of prime importance to any industry. Hence, it is fully as important to determine why employes leave as it is to build up an efficient hiring organization. Everyone knows that it is a source of expense to hire new men and acquaint them with the rules, methods, and work of the organization. When there is a continual turnover in any department, something must be done to find the cause and eliminate it. If the request for new men continues, there must be something wrong with the job. Interviewing the men who leave affords a chance of finding the trouble.

It may be that working conditions are at fault or that the job is too monotonous. Whatever the cause, it can usually be removed by changing shop regulations slightly or by occasionally transferring the men to other work. Of course, a fair percentage of the replies from the employes will be wide of the facts, but nevertheless, enough information will be obtained by careful questioning to reveal any outstanding faults as viewed from the worker's standpoint.

In most cases, the foreman will have sufficient knowledge of the men under his supervision to enable him to cope with any disturbing conditions so that wholesale quitting will be avoided. However, the present-day demands for high production all too often force the foreman to apply all his energies to obtaining output, so that he has little time to consider the individual requirements of his men. Under these circumstances, the intelligent questioning of a dissatisfied workman by an executive of the company should be welcomed by the foreman and viewed in the light of a cooperative service. It should in no way be looked upon as a reflection on his personal ability or judgment.

M. BUSWELL

SCARCITY OF SKILLED HELP IN THE AUTOMOBILE INDUSTRY

Executives of automobile shops complain in busy seasons about the lack of skilled labor and the necessity of hiring men who have never been inside a machine shop to operate expensive machine tools. Each time the employment manager hires an unskilled workman, he places a financial burden on the company; it costs money to teach the man to run a machine, and if he proves unsatisfactory, this investment is lost. Thus with a large labor turnover, the total loss soon looms large.

Unskilled men often cause losses by damaging equipment or work and by holding up production. Recently, in an automobile plant, the writer saw two machine tools, which cost $12,000 apiece, tied up for several days because of repairs made necessary by negligence. The master mechanic said that this was a common occurrence, because of the class of labor the company was obliged to employ.

With such facts at hand, it would be expected that the executives of automobile plants would advocate the establishment of apprentice systems in their shops, so that trained men would be available at least for jobs of sub-foremen. But although most of these executives have themselves served an apprenticeship, many of them are lukewarm and even cold to such a plan.

It would not be necessary to turn out toolmakers skilled in all the details of their trade. Conditions could be greatly remedied by simply setting up a separate department in each shop where men would be given a preliminary training before being placed in production lines.

OLIVER HERBERT

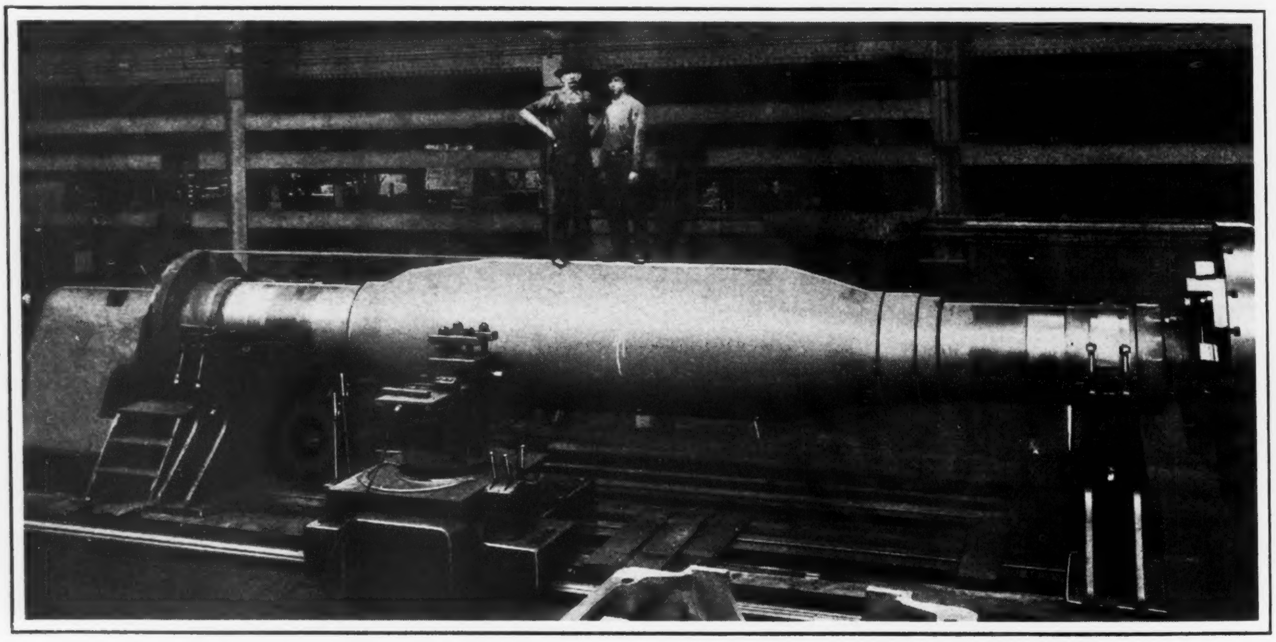
Notes and Comment on Engineering Topics

The famous Hollinger Mine in Ontario is considered America's richest gold producer. Up to the end of 1928, this mine yielded gold to the value of $145,000,000, the production entailing the milling of about 17,000,000 tons of ore.

It is estimated that in January, 1926, the ratio of the number of people in the world to the number of automobiles in existence was 71 to 1; the year following, it became 66 to 1; and at the beginning of 1928, it was 64 to 1. In January, 1929, with a population of 1,949,000,000 and 32,028,584 automobiles, the new ratio became 61 to 1. Not counting the United States, the ratio would be 1 automobile to 247 persons. The United States leads in the use of the automobile, there being less than five persons to each car, while the Hawaiian Islands is second with six persons to every car.

Telephone booths for the use of automobilists whose cars may become disabled in rural districts are being installed by the German Government along some of the main highways. The telephones are spaced about three miles apart and are connected with service stations that are open day and night.

The new vehicular tunnel under the Detroit River between Detroit and Windsor, Canada, is being constructed on dry land in sections that are launched, floated into position, and sunk to their places at the bottom of the river. Each 250-foot section of the tunnel, with an outside diameter of 35 feet and an inside diameter of 31 feet, is constructed on regular launching ways much like a steel ship. The sections are built of strips of steel plate, electrically welded together, using General Electric welding machines. After all the joints have been tested for possible leaks, bulkheads are placed at the ends, and the huge tube is launched and towed to another plant where concrete is poured to form the lining and outside covering. The shell is then towed to the tunnel site and sunk into a ditch in the river bed that has been dredged out for it, and assembled to the previously located sections.



Machining a Shaft 4 1/2 Feet in Diameter by 32 Feet Long, and Weighing 70 Tons

MACHINING A LARGE SHAFT

One of the largest shafts ever made was recently machined in the shops of the Westinghouse Electric & Mfg. Co. at East Pittsburgh, Pa. This shaft weighs approximately 140,000 pounds and has a maximum finished diameter of 53 inches with an overall length of 32 feet. The forging was made by the Midvale Steel Co. from an octagonal ingot which was approximately 82 inches in diameter and weighed 290,000 pounds. The shaft carries the rotating parts of a 60,000 kv-a. horizontal generator for use in the testing laboratories of the Westinghouse Electric & Mfg. Co. The shaft is supported by two bearings each 30 inches in diameter by 60 inches long.

Directions for Grinding Carboloy Tools

Methods that have Proved Successful in the Grinding of Turning, Boring, Facing, and Grooving Tools Made from Carboloy

IT has generally been assumed that the grinding of Carboloy tools is a difficult operation. This is not altogether correct. It is not any more difficult to grind Carboloy tools than other metal-cutting tools, but the methods used are different. It is, therefore, necessary to make a special study of the methods used in grinding these tools before attempting to sharpen or grind cutting edges on them. On account of the great cost of the Carboloy material used for the tips of the tools, great precaution should be taken to prevent waste in grinding.

When Carboloy was first placed on the market, the problem of grinding was a serious one, since there were few abrasive wheels available for doing this work satisfactorily. Since that time, however, several wheel manufacturers have developed abrasive wheels for both rough- and finish-grinding of Carboloy tools, and further developments in this direction are being made. It is likely that shortly there will be no greater difficulty in grinding Carboloy than in handling other cutting metals.

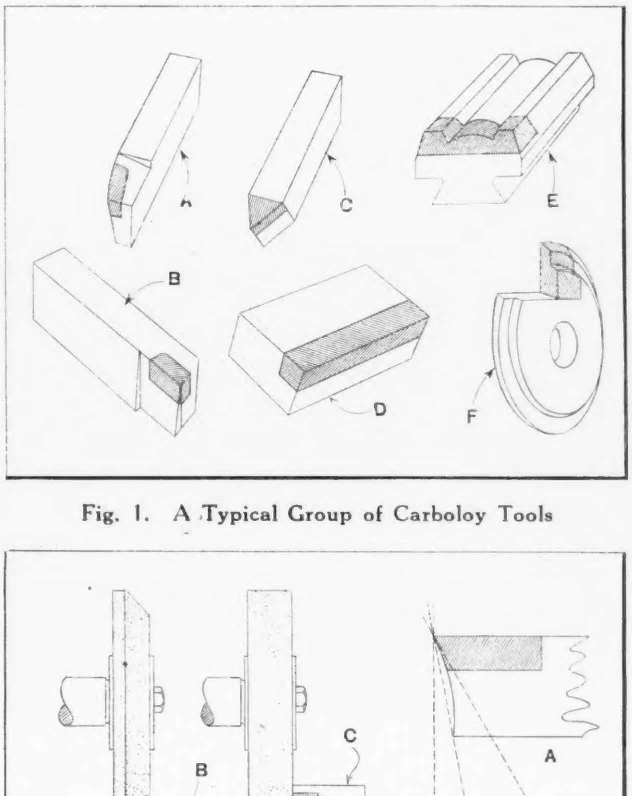


Fig. 1. A Typical Group of Carboloy Tools

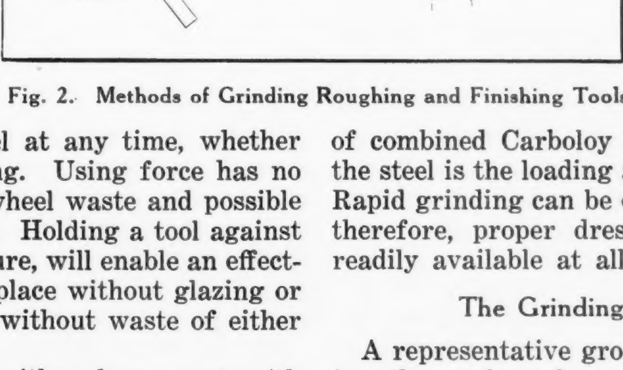


Fig. 2. Methods of Grinding Roughing and Finishing Tools

General Directions for Grinding Carboloy Tools

The following directions for grinding Carboloy tools are given in the publication *Carboloy:* The tool should not be crowded against the wheel at any time, whether in rough- or finish-grinding. Using force has no value and tends to cause wheel waste and possible injury to the Carboloy tip. Holding a tool against the wheel, with light pressure, will enable an effective cutting action to take place without glazing or loading of the wheel, and without waste of either the tool or the wheel.

Carboloy can be ground either dry or wet, with equal results. When dry grinding is being done, the tool should not be allowed to become too hot. If it should become heated above normal, too much pressure is being applied. The tool may then be cooled by submerging the shank (not the tip) in water, until the tool cools sufficiently to continue grinding. The larger sizes of tools usually become heated slightly. Therefore, several tools should be handled at one time, so that no time will be lost in waiting for a tool to cool. The operator can work first on one tool, then shift to another, and so on.

In wet grinding, an adequate flood of coolant should be kept on the tool at all times. If the grinding is started dry and then followed with a dash of water, there is a likelihood of checking the Carboloy tip. Pedestal machines used for wet grinding should be supplied with plenty of water, or better yet, they should have a positive stream of water fed by a pump. Surface and cylindrical grinding machines should also be equipped with an adequate water supply for wet grinding.

Wheel Dressing Methods

Better grinding results are obtained by keeping the abrasive wheels in good condition. Occasional dressing of the wheel, either with a dresser or a diamond, is highly advantageous, because a loaded or glazed wheel only retards the removal of metal and creates excessive heat. When only Carboloy is being ground, there is practically no wheel loading, but when a surface of combined Carboloy and steel is being ground, the steel is the loading agent that glazes the wheel. Rapid grinding can be done only by a clean wheel; therefore, proper dressing equipment should be readily available at all grinding machines.

The Grinding of Typical Tools

A representative group of Carboloy tools, showing the various forms of grinding most usually encountered, is illustrated in Fig. 1. For a tool such as shown at *A*, hand-grinding will be found quite satisfactory. The top rake, however, can be finished on a surface grinder, if desired, using a pedestal grinder for the front and side rakes. When

Fig. 3. Rough-grinding a Carboloy Lathe Tool

Fig. 4. Finish-grinding a Carboloy Lathe Tool

this is done, it is not necessary, in most cases, to regrind the top rake again for redressing. The front and side faces are merely touched up, taking off just a sufficient amount of material to produce a sharp cutting edge. When the top rake angle or top face of the tip is ground at each dressing, the tool soon becomes worn out, because the Carboloy becomes too thin for use. Usually, when the top is redressed too often, half of the tool life is wasted. Then, too, in tools used for turning purposes, the relative position of the center line of the work and the cutting edge of the tool will be incorrect; the tool will be cutting too far below center, a condition likely to cause chatter.

Tools such as shown at *B*, *C*, and *D* can be ground satisfactorily on surface grinders, either dry or wet, holding them in a universal vise, so that the proper angles can be obtained. The form tool at *E* is also ground on a surface grinder, although the wheel must be dressed to the proper radius by an accurate dressing device, using a diamond dresser. When tools of this type, having several radii and grooves are to be ground, it is necessary to grind only one section at a time, due to the difficulties that result in keeping the shape of the wheel true. A similar procedure is required for the circular form tool at *F*, which is handled on a cylindrical grinding machine. In both cases, of course, it is only necessary to grind the top face in redressing, removing just enough metal to produce a sharp edge.

In redressing a lathe and boring-mill tools on a pedestal grinder, the cutting edges can be roughed on the periphery of the wheel, and then finished on the side, so that the angular faces will be straight rather than concave. The dished edge is not highly objectionable, but when finished this way, the actual cutting edge is likely to be too acute. The example at *A*, Fig. 2, shows this condition rather clearly, in that the 10-degree angle, as measured across the top and bottom of the tool, is actually 30 degrees, far too much to insure a proper support under the cutting edge. Because of this condition, the straight angle is recommended.

To overcome some of the "dish" or concavity, the wheel can be dressed at a 45-degree angle as shown at *B*, which will be found satisfactory for roughing purposes. After roughing, the finishing tool can be ground as shown at *C*, using the side of the wheel. A large cup-wheel with a straight side is preferable, however.

Examples of Grinding Operations on Carboloy Tools

Some representative grinding operations, performed on a variety of Carboloy tools, are shown in the accompanying halftones. The rough-grinding of a Carboloy lathe tool is illustrated in Fig. 3. The edge of the wheel has been dressed to a 45-degree angle, so that the amount of concavity is reduced to a minimum. The finish-grinding of a similar tool is shown in Fig. 4. For this operation, a flaring-cup abrasive wheel is used, and the machine is equipped with an adjustable support, so that the proper clearance angle on the tool may be maintained. Roughing of Car-

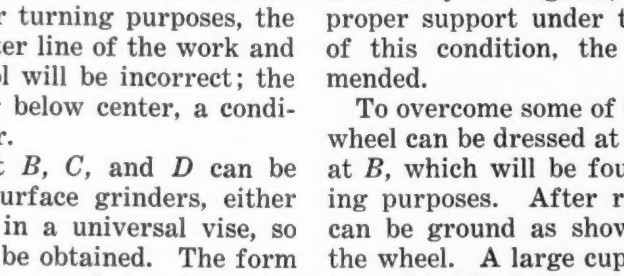


Fig. 5. Grinding a Boring-mill Tool on a Surface Grinder

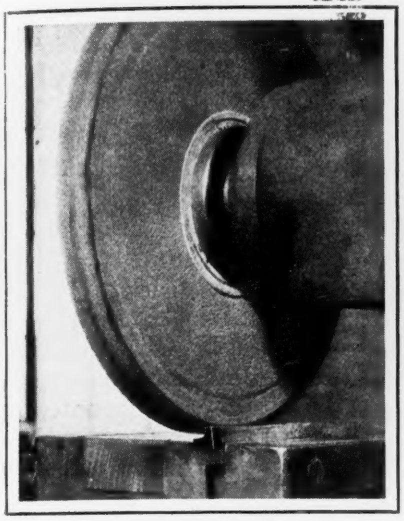


Fig. 6. Grinding a Formed Tool with a Formed Wheel

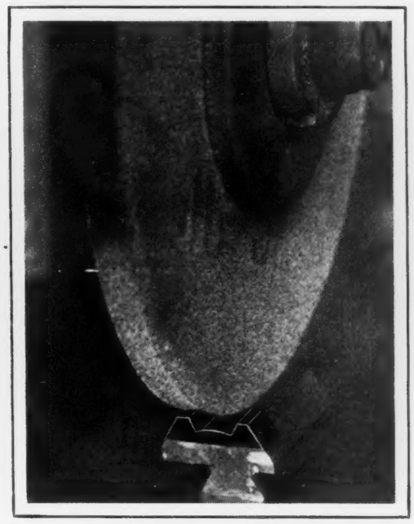


Fig. 7. Another Form-grinding Operation

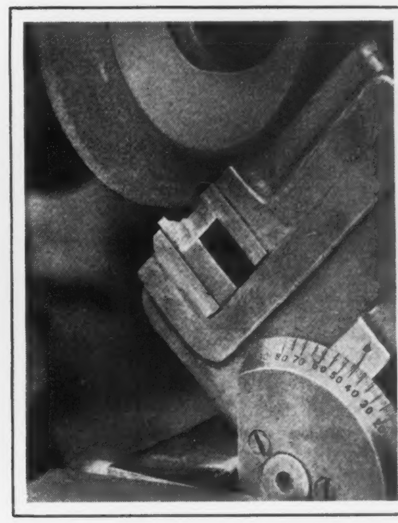


Fig. 8. Grinding a 45-degree Edge on a Formed Tool

boloy tools should be done with a 60- or 80-grain wheel, and finishing should be done with a 100- or 120-grain wheel.

As previously mentioned, the top rake of the tool can be ground on a surface grinder, if desired, and in Fig. 5 is illustrated a set-up for grinding a 1- by 1 1/4-inch boring-mill tool. The tool is held in an adjustable vise, which, in turn, is mounted on the magnetic chuck of the machine. The amount of stock to be removed per cut should not exceed 0.002 inch. The grinding should be arranged so that the wheel cuts away from the cutting edge, thus eliminating the possibility of chipping the Carboloy tip.

Grinding Carboloy Forming Tools

Various types of form tools can be ground in a surface grinding machine by dressing the wheel to the proper form and dividing the operation into a roughing and a finishing operation. The form-grinding of a tipped tool having a 0.250-inch radius at the cutting edge is illustrated in Fig. 6. A truing device is provided for dressing the wheel to the proper radius. The grinding of the tool requires considerable care, and the amount of metal to be removed per grind should be about 0.0005 inch per cut.

Another form-grinding operation is illustrated in Fig. 7, which shows the grinding of a finish-form tool for a turret lathe set-up. In this case, the work is held directly on the magnetic chuck. In Fig. 8 is illustrated a set-up for form-grinding a tool having an irregular cutting edge composed of two 45-degree angular sections, and three straight cutting surfaces in different planes. The finish-grinding of a circular form tool is illustrated in Fig. 9. Tools of this kind are ground in the usual manner, being supported on an arbor and finished by dressing the abrasive wheel to the proper form. Another type of form-grinding operation is illustrated in Fig. 10, the tool in this case being of a more complicated nature.

End-mills, reamers, spot-facers, and cutters are rough- and finish-ground in a conventional form

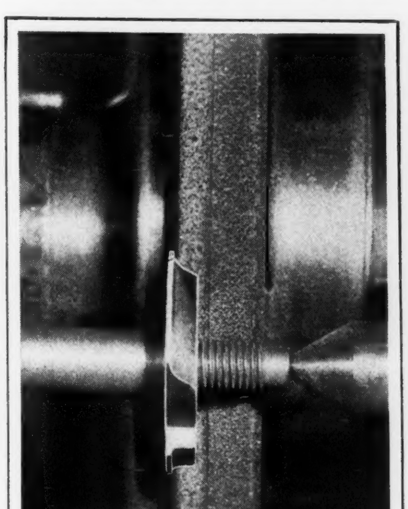


Fig. 9. Finish-grinding a Formed Carboloy Tool with a Formed Wheel

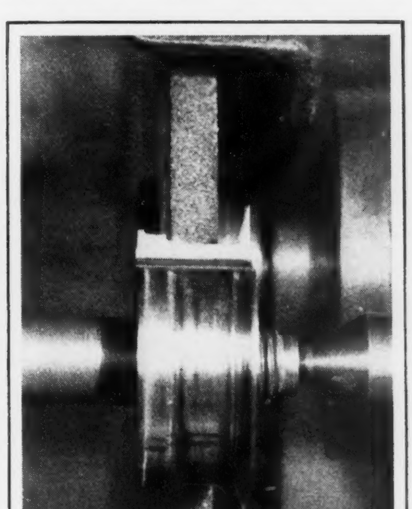


Fig. 10. Another Example of the Grinding of the Contour of Formed Tools

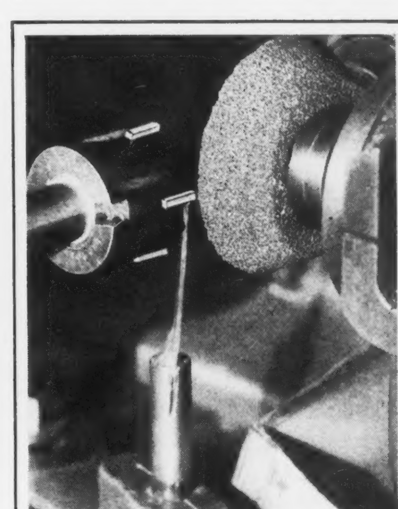


Fig. 11. Grinding an End-mill with Carboloy Inserts in a Cutter Grinder

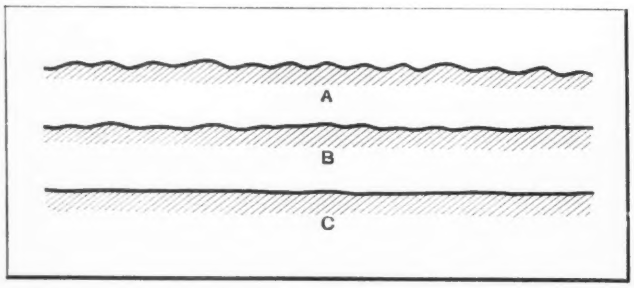


Fig. 12. Magnified Cutting Edges of Ground, Honed, and Lapped Carboloy Tools

of cutter grinder, as illustrated in Fig. 11. The cutter shown is made with five Carboloy inserts that require grinding on two faces. The set-up illustrated is for the outside diameter; the front cutting edges are finished by mounting the cutter on a stub arbor, so that it is presented to the abrasive wheel at a 45-degree angle to that shown. In finish-grinding a cutter of this type, the last two or three cuts should be arranged to remove not more than 0.0001 inch of metal.

Diamond-Lapping of Carboloy Tools

When a Carboloy tool is finish-ground by an abrasive wheel (60 to 120 grains), the cutting edge appears to be sharp and smooth, but if examined by a 50-power magnifying glass, it will appear somewhat as shown at *A* in Fig. 12. Stoning or honing will improve the sharpness of the cutting edge, as shown at *B*, but there will still be a slight sawtooth effect, noticeable under high magnification. For the average class of work, these edges will suffice as far as cutting qualities, life of tool, and finish of work are concerned.

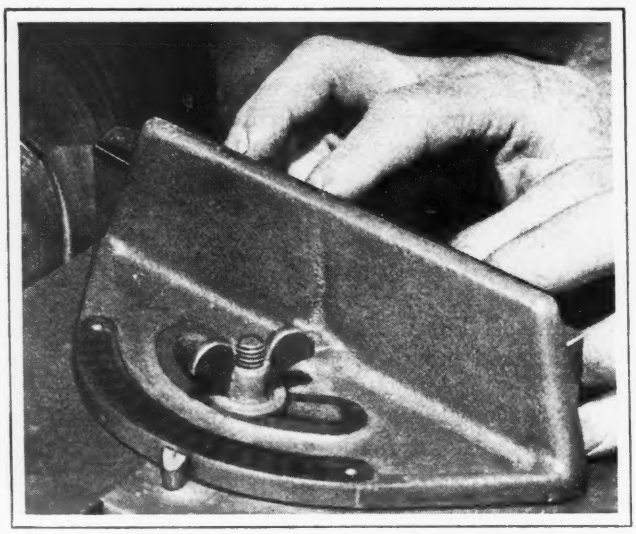


Fig. 13. Diamond-lapping of a Carboloy-tipped Tool

However, there are a great many cases where a high finish is required, and it is therefore necessary to diamond-lap the cutting edges of the tool in order to maintain the required accuracy and insure a satisfactory life between grinds.

Diamond-lapped tools are used extensively in the finishing of non-ferrous metals, Bakelite, hard rubber, and fiber. A lapped edge, when examined under high magnification, appears as shown at *C*. An example of the relative value of a diamond-lapped edge is found in the finishing of babbitted crankshaft bearings, where the life of the tool between grinds runs 4 to 1 in favor of the lapped edge. On a recent drilling operation in Bakelite, a finish-ground cutting edge completed 120 pieces between grinds, whereas the same tool finished with a lapped edge completed more than 500 pieces between grinds. This condition does not exist in heavy roughing operations, where the extreme edge of the tool is not required to produce a fine finish.

The diamond-lapping of a Carboloy-tipped tool is illustrated in Fig. 13. The operation is performed after the finish-grinding, so that very little material is to be removed. The machine is of the horizontal type, having a revolving lapping plate directly driven by an electric motor. In using this type of lapping machine, it is essential that there be no end play in the spindle, because any lost motion in the revolving plate would cause a wavy cutting edge. The machine is equipped with a table that can be adjusted to any desired angular position; an auxiliary angular support is mounted on the top of the table as shown. With this combination, it is possible to lap compound angles. The tool shown is being lapped with a 6-degree angle on the nose and with a 5-degree end clearance away from the cutting edge.

Horizontal lapping machines are also applicable to the finishing of Carboloy tools; Fig. 14 shows such a machine being used for finish-lapping the top face of the circular form tool illustrated in Fig. 10. The face is lapped by holding the tool against the lapping plate and oscillating it slightly as the plate revolves.

For the average type of tools requiring lapping, an allowance of approximately 0.002 to 0.003 inch should be allowed. If the cutting edge is to be hand-lapped, in addition to being machine-lapped, there should be an allowance of approximately 0.005 inch on a side.

In Figs. 15 and 16 are illustrated lapping operations performed in making piston grooving tools. The lapping plates are charged with diamond dust, and are coated with a paste of diamond dust and

Fig. 14. Lapping on a Horizontal Lapping Machine

olive oil on the lapping surface. This combination affords quick cutting, and likewise produces an exceptionally smooth finish. However, the high luster and final finish of this form of tool is produced by hand-lapping, as illustrated in Fig. 17. The plate is also of the diamond-charged type, and is made with a serrated face as shown. The final 0.0001 inch of stock should be removed on a dry section of the plate in order to produce a mirror finish.

* * *

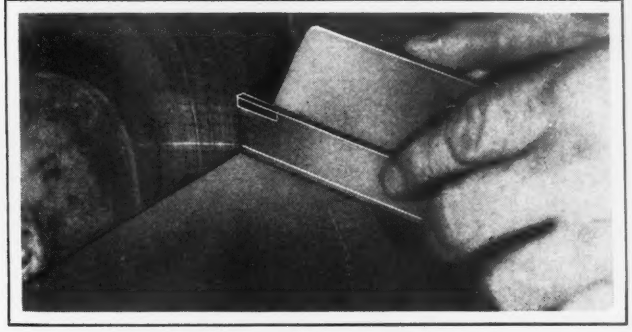


Fig. 15. Machine-lapping Operation on a Piston Grooving Tool

CHROMIUM-PLATING ALUMINUM

It is claimed that aluminum castings, stampings, and flat sheets have been successfully chromium-plated by a process discovered by Harry F. Gardner, formerly of the U. S. Bureau of Standards. It is understood that this process is being used commercially by the Perma-Chrome Process Corporation of Cleveland. An aluminum sheet, to which the chromium-plating had been applied, showed a scleroscope hardness of 16, as compared with a hardness of 7 for the bare metal. The chromium-plated aluminum is said to remain bright after long exposure to boiling water, fruit juices, and the various organic liquids formed during cooking. It is believed that the increase in hardness resulting from chromium-plating will be used to advantage in the case of gas engine pistons and other parts that must resist wear; also, it may help solve the problem of preventing corrosion of airplane parts.

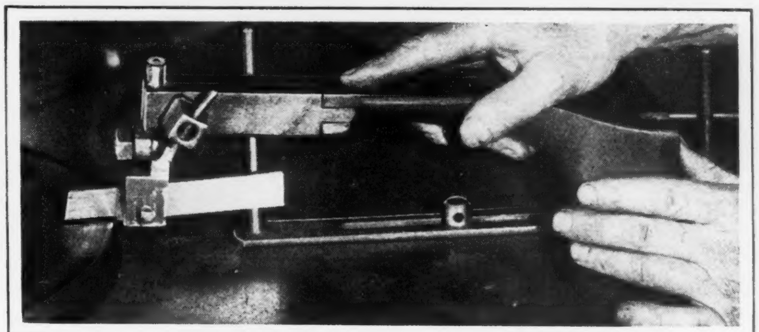


Fig. 16. Machine-lapping Another Piston Grooving Tool

* * *

In the period between 1927 and 1928, the United Kingdom furnished 80 per cent of the metal-working machinery imported into India. The United States followed with 10 per cent, while Germany contributed 8 per cent.

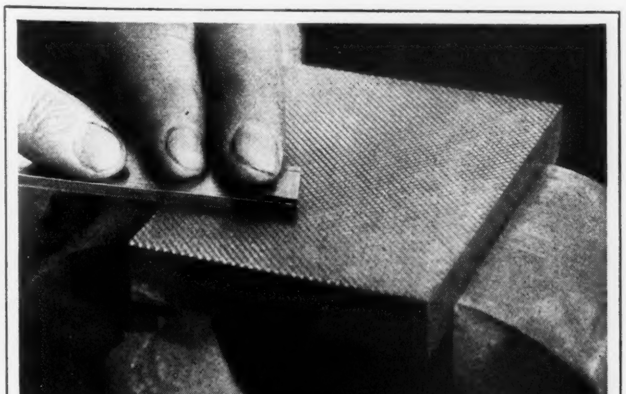


Fig. 17. Hand-lapping a Piston Grooving Tool

INDUSTRIAL ENGINEERS' MEETING IN CLEVELAND

The Sixteenth National Convention of the Society of Industrial Engineers was held at Hotel Statler, Cleveland, Ohio, October 23 to 25. The keynote of the convention was "Trends in Industry." This subject was discussed under numerous sub headings, among which may be mentioned mergers, lower distribution costs and their effect on manufacturing profits, demand for skilled mechanics, new accounting methods, new concepts of personnel relations, limiting the age of employes in industry, trends in time-study engineering, and wage incentive plans. An interesting topic dealt with "The Machine Age and Its Effect on Industry."

* * *

PRACTICAL EXPERIENCE MUST BE SUPPLEMENTED BY STUDY

Every day we observe thousands of practical facts, but we do not usually bother to connect them with one another. Such a process of observation is necessarily haphazard, and, as a means of obtaining knowledge, it has two grave weaknesses—first, it is narrow in scope, and second, it is often unreliable. Practical facts derived from everyday experience are narrow in scope because our lives have grown too specialized to allow us a wide variety of experiences. A man who works all day doing production work on a lathe has little opportunity to learn by observation much about metal stamping or heat-treatment of steel, or numerous other things that he would like to know. Everyday experience educates by concerning itself mainly with individual facts, and there is such a vast number of these that in the course of one lifetime no one can hope to acquire a very large proportion of them. In an age of specialization, practical experience alone is an inefficient educator, even though all of one's observations are accurate.

A NEW PROCESS FOR MAKING MALLEABLE IRON CASTINGS

A number of advantages are claimed for a new annealing process for the production of malleable iron castings, particularly the saving of many days in carrying out the malleableizing process. The new method has been developed by the Erie Foundry of the General Electric Co. After ascertaining the proper temperatures and time involved to effect the required changes in the metal, it was found that, by the use of electric furnaces, a cycle of operations as near as possible to the ideal could be obtained.

Three electric annealing furnaces are used for this purpose at the foundry referred to, each of which is rated at 325 kilowatts and uses nickel-chromium ribbon resistor heating elements. The connections are arranged to allow a power input of 52, 170, or 325 kilowatts, as desired. The capacity of the installation is 100 tons of castings per week. In operation, the hard castings, of commercial composition, are packed on the bottom of the car, without iron plates or boxes. It was found that the best results were obtained by stacking the charge directly on the floor of the car.

Fig. 1. Truck Loaded with Castings, Ready to go into the Furnace

The charge is then placed in a furnace and heated to a sufficiently high temperature to effect solid solution of free cementite, whereupon the charge is transferred, without removing it from the car, to another furnace for cooling. In this furnace the castings are brought to a temperature below 1380 degrees F. (750 degrees C.) which is held for approximately four hours, after which the temperature is suddenly lowered a few degrees and maintained at this point for another four hours, this step then being repeated. The castings are next transferred either to a cooling furnace or left to cool in the air; or they may be quenched immediately, resulting in increased strength, without brittleness. The average time for a six-ton anneal is between twenty-eight and thirty hours.

Tests made by the General Electric Co. show that the tensile strength, yield point, and other characteristics are practically the same with this short-cycle anneal as with the older methods. It was found that the short-cycle malleable iron can be machined more easily than the long-cycle product. Very little skin is found, and the castings can be cleaned somewhat easier than the old type of product. The castings may be galvanized without embrittlement and without previous or subsequent treatments. The tests also showed a reduction in warpage.

The advantages as found by the General Electric foundrymen are as follows: (1) The elimination of boxes and packing material, reduced labor cost, and a much cleaner operation. (2) Reduction of time, resulting in less inventory, shorter deliveries, and a saving in space and furnace investment. (3) The easy control of the annealing process by varying the cycle, to meet variation in metal composition. (4) Lower total cost.

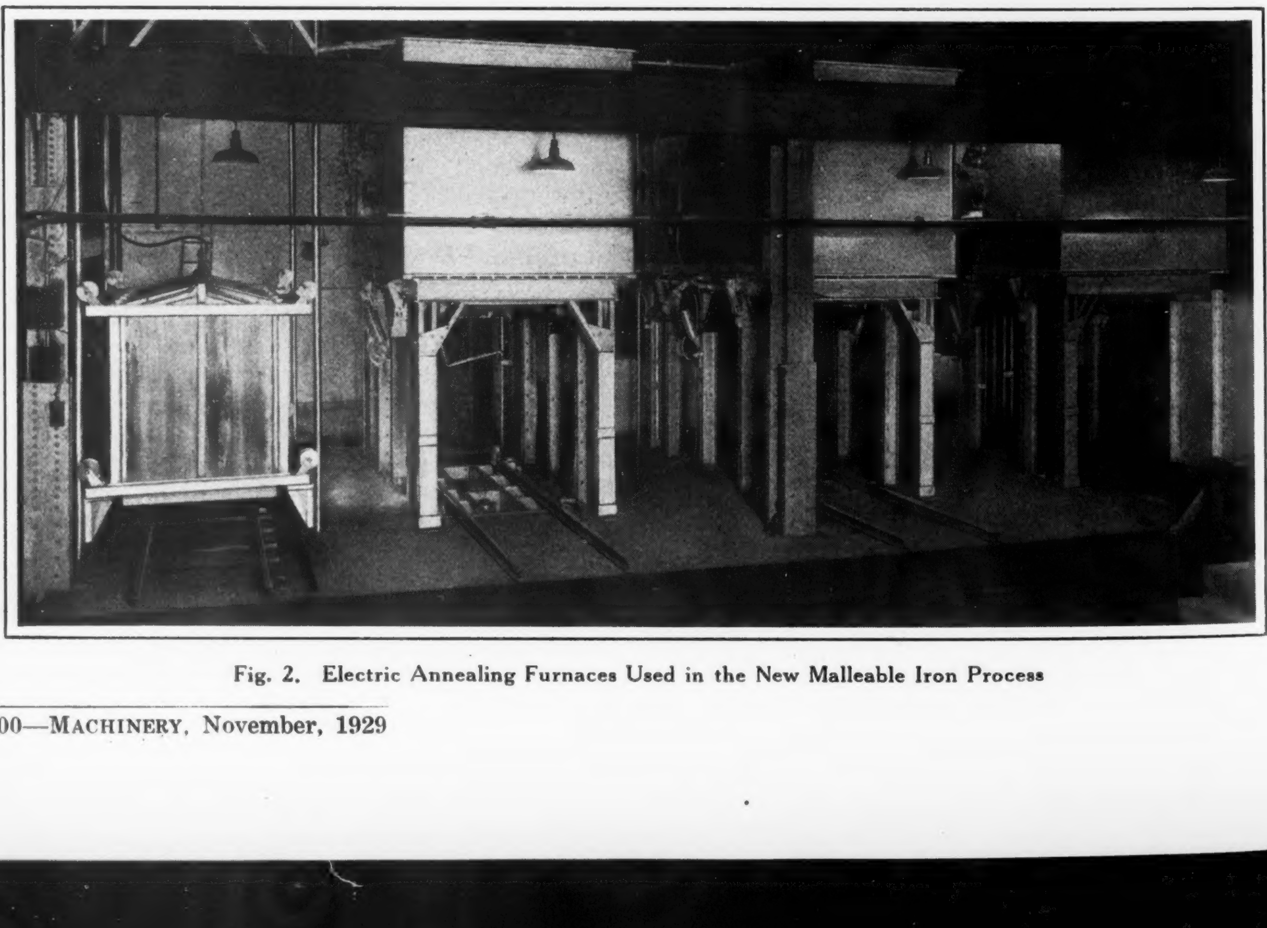


Fig. 2. Electric Annealing Furnaces Used in the New Malleable Iron Process

Sheet-Metal Rolling and Forming Methods

Application of Rolling and Shearing Equipment in the Production of Sheet-metal Parts—Last of Three Articles

By FRANK H. MAYOH

PREVIOUS articles in August and September MACHINERY, pages 913 and 53, respectively, dealt with rolling and forming operations on sheet-metal parts. The present article contains additional information on methods and equipment used in sheet-metal forming.

Revolving Shears

Many types of revolving shear devices are employed for stripping and cutting sheet-metal products, but the one shown diagrammatically in Fig. 10 is unusual, inasmuch as it shears a tubular part from the inside, thereby throwing the burr outward, which is desirable in many cases. The driving pulley revolves shafts *A* and *B* through the medium of gears.

The sheet-metal sleeve *D* to be cut or trimmed has previously been rolled to size and has a lap seam at *E*. This sleeve is placed in the machine on the rolls *F* and *G*. Roll *F* has an adjustable collar *H*, which gages the length of the work from the opposite end. The shearing is accomplished by the cutter *J* on arbor *A*. The cutter shears against the surface *K* of roll *F*. It is adjustable vertically, the shaft on which it is mounted being carried in a sliding bearing block *L*. Cutter *J* has to be raised out of contact with the lower shearing roll *F* as each part is sheared. This is accomplished by means of a handwheel (not shown) which raises or lowers block *L*. This adjustment permits the removal of the sheared off end or scrap and the insertion of another part.

While the piece to be trimmed is being revolved by the shearing rolls, cutter *J* is forced through the sheet-metal work. The work can be put in place and the trimmed part and scrap removed without stopping the machine, as the work revolves only during the shearing cut.

Die-forming and Rolling Operations on Tapered Work

Tapered work is generally more interesting to handle than straight work. This is true whether the work is turned in a lathe, milled, or handled in a punch press. In making the tapered part shown in Fig. 11, some difficulty was experienced in finding a satisfactory method. This part, which is shown as it appears when finished in the lower views, is a formed tapered bar that was required to be bent accurately to shape.

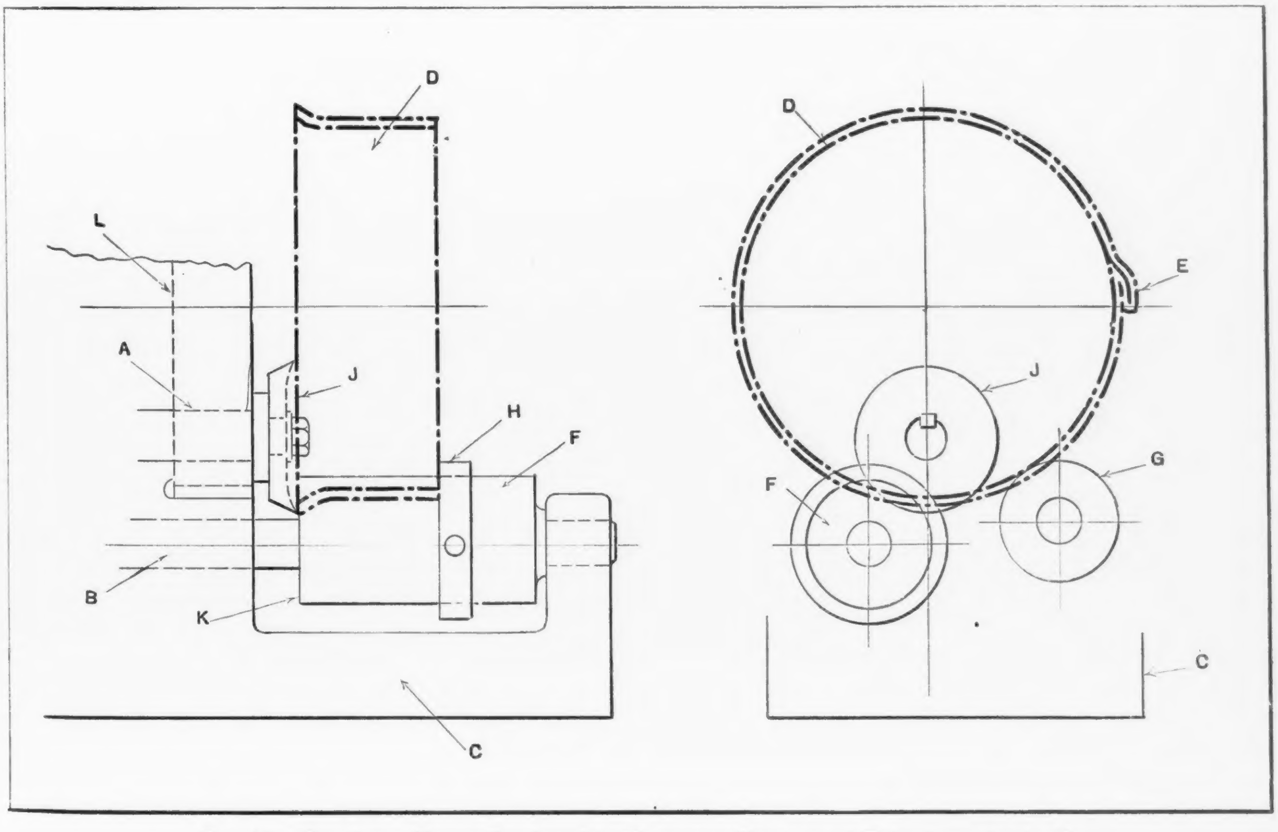


Fig. 10. Revolving Shears Employed in Trimming Sheet-metal Tube from the Inside

The blank for this part, shown in the upper view, is punched out of a flat strip of steel and then bent to shape in a forming die. It was found impossible, however, to produce a satisfactory job by this method. The work would leave the die with a crowned surface at *A*, and it was necessary to flatten this in a bumping die and finish by grinding. The grinding operation was finally eliminated, however, by forming with the die shown in Fig. 12 and afterward rolling in the manner illustrated by Fig. 13.

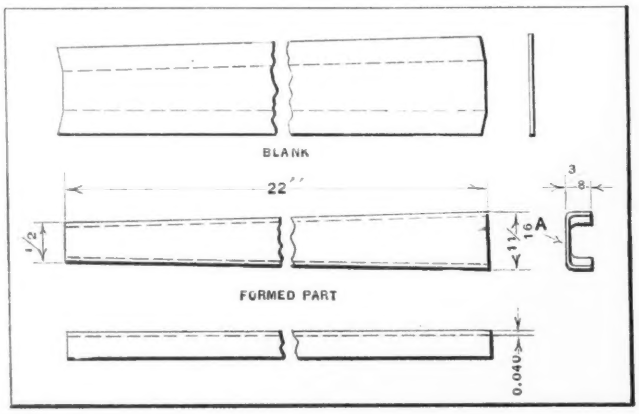


Fig. 11. Blank and Completely Formed Tapered Part

Referring to the die operation illustrated in Fig. 12, the blank *B* is located by blocks *C* (shown at the left end of the plan view which shows the die only), together with locating blocks *E* at the right. These are made to match the corners of the piece to be formed, so that the blank is simply laid on top of the die. This die has a tapered slot cut through it, the sides of which are indicated at *F* and *G*. Die-block *A* is held by screws *W* to a cast-iron base *J*, which is clamped to the bed of the punch press.

The pad *K*, which is a sliding fit in the slot in block *A*, is normally held in its extreme upper position by the springs *L*, instead of in the position shown in the illustration. The screws *M*, which limit the upward travel of this block, are so adjusted that the top of the block just makes contact with the under side of the blank *B* to be formed. Pad *K* thus holds the blank in place as the punch descends, and serves to eject the formed part on the upward stroke. The punch *H* has a slight radius on its lower end and is secured in a holder *N* by screws *P*. After putting the blank on top of the die, the operator trips the press, and as the punch *H* descends, it forms the blank to the U shape shown at *X*. When the punch ascends, the pad *K* pushes the work out of the die, so that it can be removed.

Removing Burrs by Rolling

Between the blanking and forming operations on the part *B*, Fig. 12, an incidental operation is performed, which consists of removing the burr

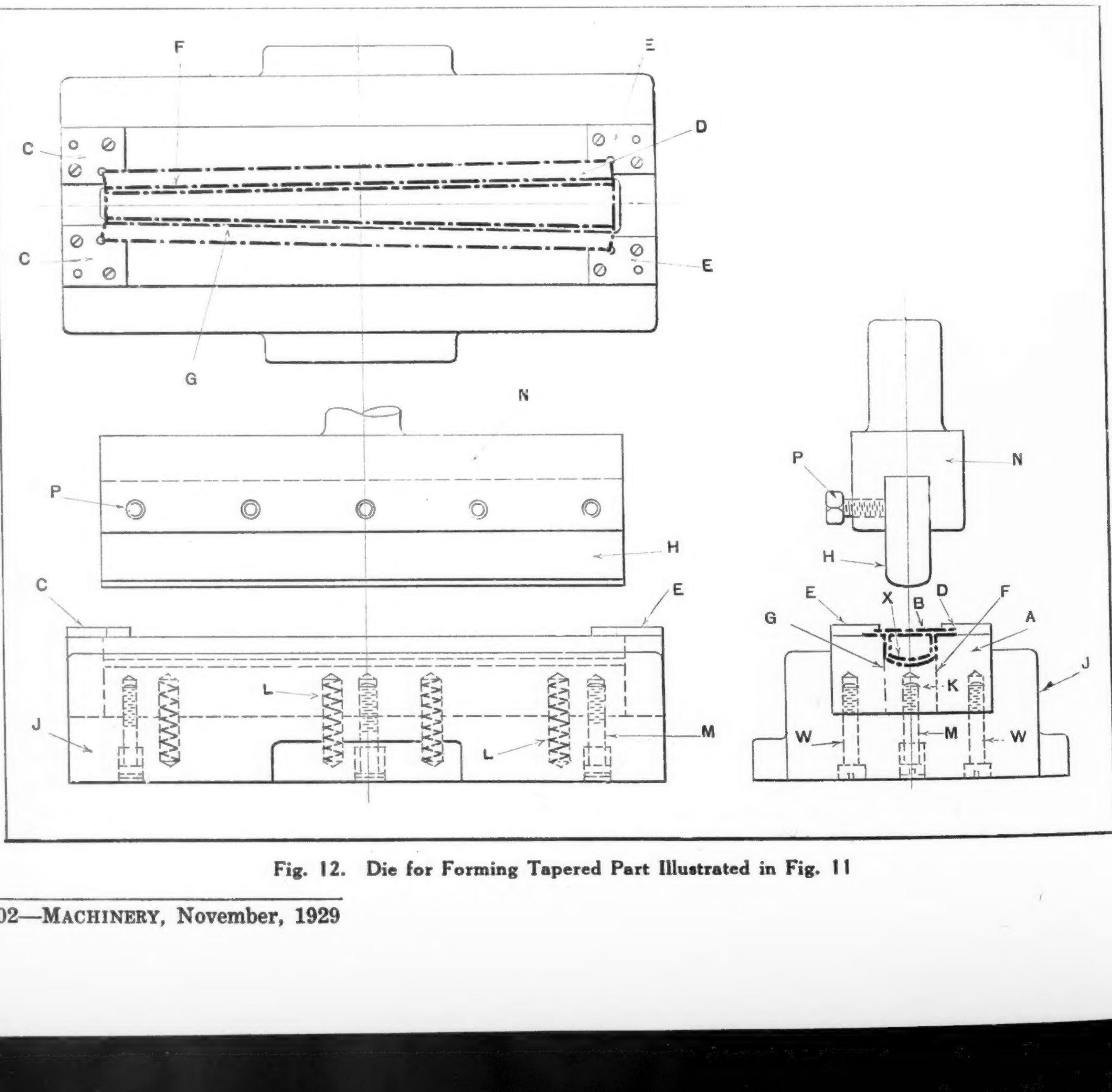


Fig. 12. Die for Forming Tapered Part Illustrated in Fig. 11

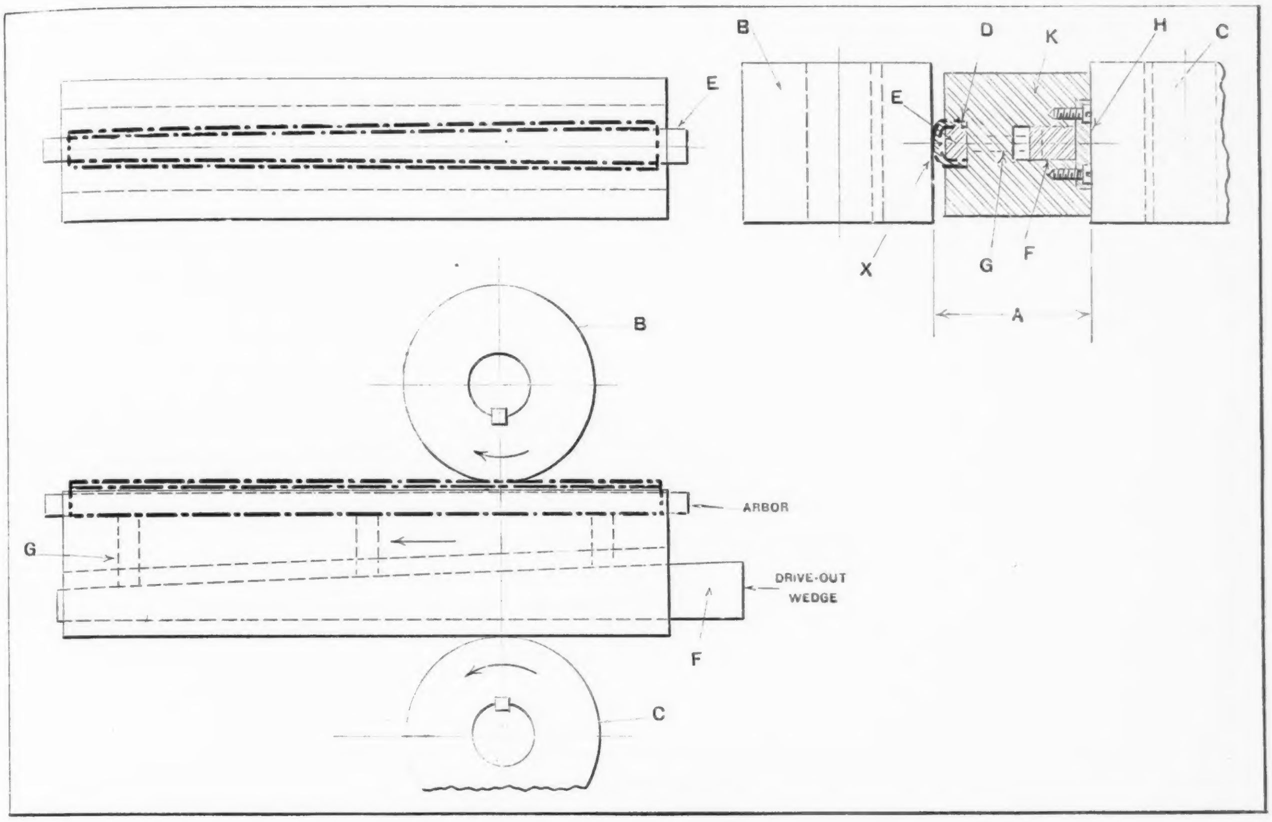


Fig. 13. Arbor and Rolls for Flattening or Removing Crown from Formed Part

thrown up by the blanking operation. This is accomplished by passing the blank between the rolls of the machine shown in Fig. 14, which consists of a continuously revolving tight pulley *A* driving a roll *B* through the medium of gears in the housing at *C*, and a corresponding set of gears at *D* which drive the upper roll *E*. A handwheel *F* at each end, operating a screw and bearing block, enables the operator to adjust the space between the rolls to the thickness of the stock. As the blank passes between the rolls, the burr is flattened out. Roll *B* is backed up at the center by a supporting roll *G*, while roll *E* is backed up by roll *H*. This machine can be used for flattening and rolling burrs on many forms of sheet-metal parts.

The machine shown in Fig. 14 is used in connection with the operation illustrated in Fig. 13. This operation requires that the entire unit enclosed by the dimension line *A*, be passed between a pair of rolls *B* and *C*. The machine shown in Fig. 14 is intended for wider work; a machine having shorter rolls with a wide range of adjustment relative to the distance between the rolls is desirable for this kind of work. A pinion-and-gear reduction unit driving mechanism designed to deliver more power at the rolling point is necessary for regular production burring work of some kinds.

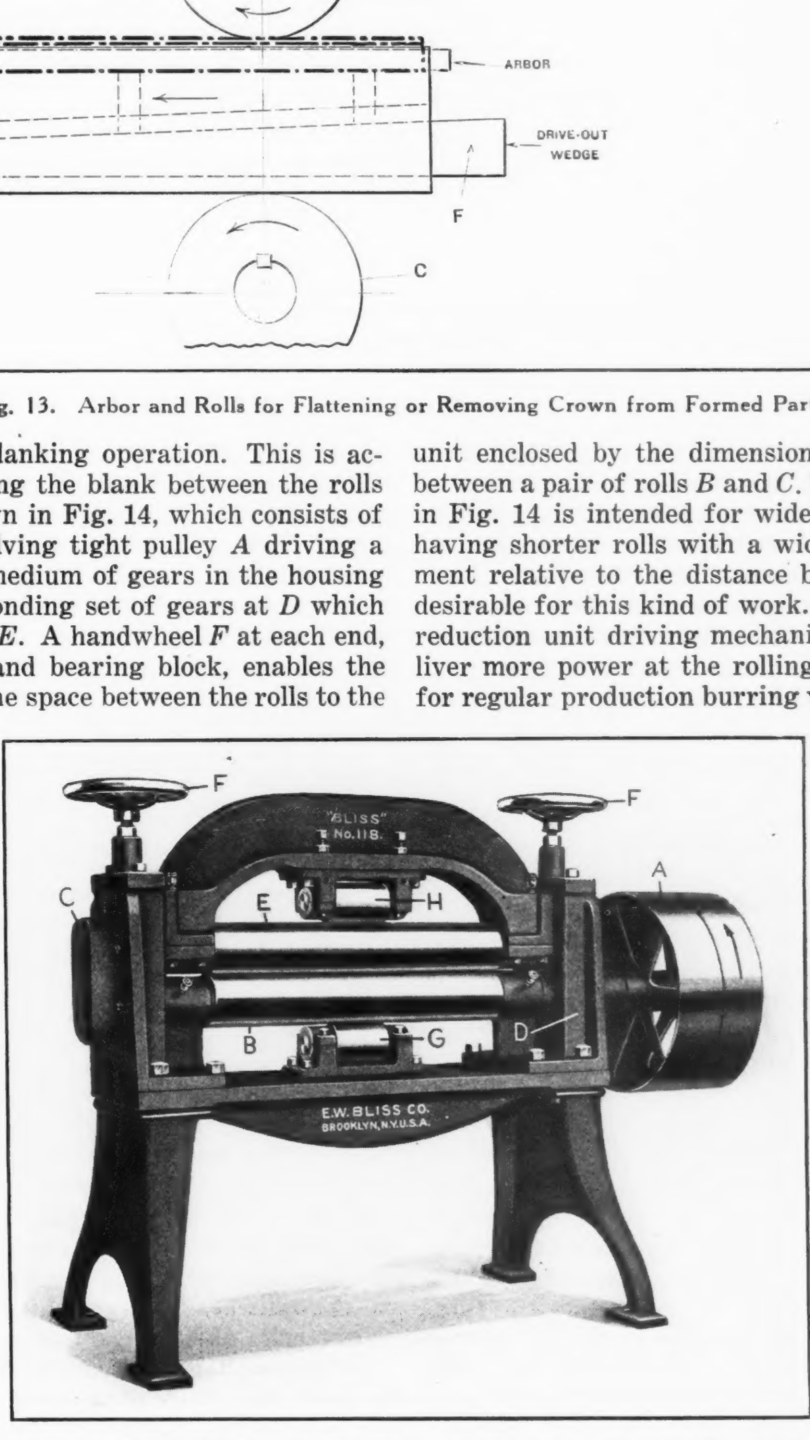


Fig. 14. Rolling Machine Used in Removing Burrs from Edges of Flat Stock

Flattening Crowned Parts

The tapered bars formed by the dies illustrated in Fig. 12 have a crown, as indicated at *X* in Fig. 13, and this, as previously stated, must be flattened. To accomplish this, a steel block *K* is employed. This block is grooved at *D* to conform with the outside of the tapered bar. An arbor *E*, likewise tapered, is forced inside the work. The tapered sheet-

metal bar and the block are then wedged together, as shown clearly by the end view.

Block K, with the entire assembly, is now allowed to pass between rolls B and C in a rolling machine with sufficient tension on the rolls to flatten the crown at X, so that the bar has the square flat top indicated by the end view at A, Fig. 11. This is a very rapid operation, as two operators handle the rolling, one at each side of the rolling machine. The machine runs continuously, one operator putting the unit in place and the other receiving it as it comes through the rolls B and C, Fig. 13, which are geared together.

A drive wedge F is employed to remove the sheet-metal tapered part from block K. This wedge has a tapered upper edge that operates against three pins G. The lower edge is supported on a substantial plate H, held in place by screws. After the work is rolled, the operator drives the large end of the wedge F, forcing the pins against the tapered arbor, and thereby driving the arbor and work out of block K. The arbor E is then removed from the work by giving it a light tap on the small end.

Another formed part is next put in place and the arbor E wedged in the block. The operation of rolling is then repeated. If an attempt is made to roll these parts without securely wedging them into the block, they will have a tendency to curl lengthwise. In considering the forming work described, it has been the aim to emphasize the advantages of utilizing rolling operations to meet certain requirements. The rapidity with which work can be handled by these methods is surprising.

In performing rolling operations, it is important that the work be supported throughout its entire length by some rigid holding means, unless the rolling operation is very light; for example, a part already formed, which has a cross-section area sufficient to withstand a light rolling operation without bending or curling, can be finished without providing the usual support.

* * *

Automatic Method of Assembling

The article "Assembling Small Parts by Vibration," to be published in December MACHINERY, describes a most unusual method for rapidly assembling several small electrical switch parts. These parts are piled on honeycombed plates provided with a great number of holes. The plates are vibrated rapidly, causing the parts to drop by gravity into the holes. By removing the plates from the machine after the holes are filled and placing them in such a manner as to allow the parts in one plate to drop from that plate and assemble with those in another plate, a great number of parts are assembled simultaneously. The machine for accomplishing this remarkable result will be described in detail in this article.

MILLING CUTTERS WITH WELDED BLADES

Large size milling cutters with blades welded into slots milled in the cutter body have recently been developed by the Brooke Tool Mfg. Co., Ltd., Birmingham, England. The body of the cutter is of a tough medium steel, with approximately one third of the blade projecting. As the blades during the life of the cutter, are ground down, new chip clearance may be milled out on the cylindrical surface of the body. The cutter may be used until nearly two thirds of the blades have been ground off.

FIFTIETH ANNIVERSARY OF THE A. S. M. E.

In April, 1930, the American Society of Mechanical Engineers will celebrate its Fiftieth Anniversary. Many of the world's outstanding engineers will meet April 5 to 9, inclusive, in New York, Hoboken, and Washington to celebrate this anniversary of the founding of the society. Papers will be presented by prominent engineers from sixteen different countries and geographical divisions of the world. These papers will not be technical in character, but will stress what engineering has done for each country, both in a national sense and for the advancement of world civilization.

The program will be carried out in three parts. On April 5 the delegates will be conducted to the McGraw-Hill Publishing Co., New York City, and will meet in the offices of the *American Machinist* because the preliminary meeting of the organization of the society was held in the offices of that publication on February 16, 1880. The second portion of the program will be held April 6 at Stevens Institute, Hoboken, N. J., where the final organization meeting of the society was held on April 7, 1880.

The third part of the program, at the main sessions of which sixteen of the world's distinguished engineers will present a summary of their papers, will be held in Washington on April 7 and 8. Washington has been selected for this part of the celebration because of the national and international character of the event. Honorary memberships will be awarded to men who have rendered conspicuous services to the society and to engineering throughout the world, and the Holley, Melville, Gantt, A.S.M.E., Fiftieth Anniversary, and other newly founded medals of distinction will be conferred. A reception will be given at the White House for the delegates and members of the society and their guests.

* * *

There is a general impression that the mileage of the railroads of the United States has not increased materially in the last fifteen or twenty years. This is true as far as the actual miles of line are concerned. The railroads of this country operate about 259,000 miles of line, and there has been but relatively little change in this figure for many years. The total mileage of tracks operated by the railways, however, including double tracks, yard tracks, and sidings, has increased about 59,000 miles since 1911, or from 363,000 to 422,000 miles. In other words, there has been a considerable railway development, equal to the building of nearly 60,000 miles of single track in the last sixteen years.

Copper Brazing in Electric Furnaces

Fabricating Drawn and Cast Steel Parts by Copper Brazing in an Electric Furnace with a Hydrogen Atmosphere

By H. M. WEBBER, Industrial Heating Engineering Department, General Electric Co., Schenectady, N. Y.

An active field for copper brazing is found at present in the manufacture of electric refrigerator parts, such as evaporators, floats, check valves, pistons, etc. The process lends itself admirably to the fabrication of such parts because the work comes from the furnaces clean, bright, and strong. The copper-steel alloy which forms at joints of the pieces is capable of withstanding higher temperatures and pressures than tin solder or silver solder, and the work shows marked improvement in appearance over soldering or welding. Several applications of brazing have arisen from the fact that some parts could not be welded because of the delicacy or intricacy of the shapes, or because the cleaning required would make the cost prohibitive in comparison with brazing.

Copper brazing, as described in this article, is performed in electric furnaces containing reducing atmospheres of hydrogen or mixed hydrogen and nitrogen. The temperatures used are around 2100 degrees F. (1150 degrees C.), which is slightly above the melting point of copper. Owing to the presence of a protective atmosphere, nickel-chromium ribbon resistors operating at high-watt densities can be used for the heating elements.

If two pieces of steel are joined tightly together and a small quantity of copper is placed adjacent to the seam, the whole being heated until the copper melts, it is known that the copper will flow rapidly without flux into the joint and be distributed evenly throughout the contact area by means of capillary attraction. Since capillary attraction aids so readily, it follows that the distribution of copper improves with the tightness of the fit. Only a very thin film of copper forms the bond, and when properly applied its cost is almost negligible.

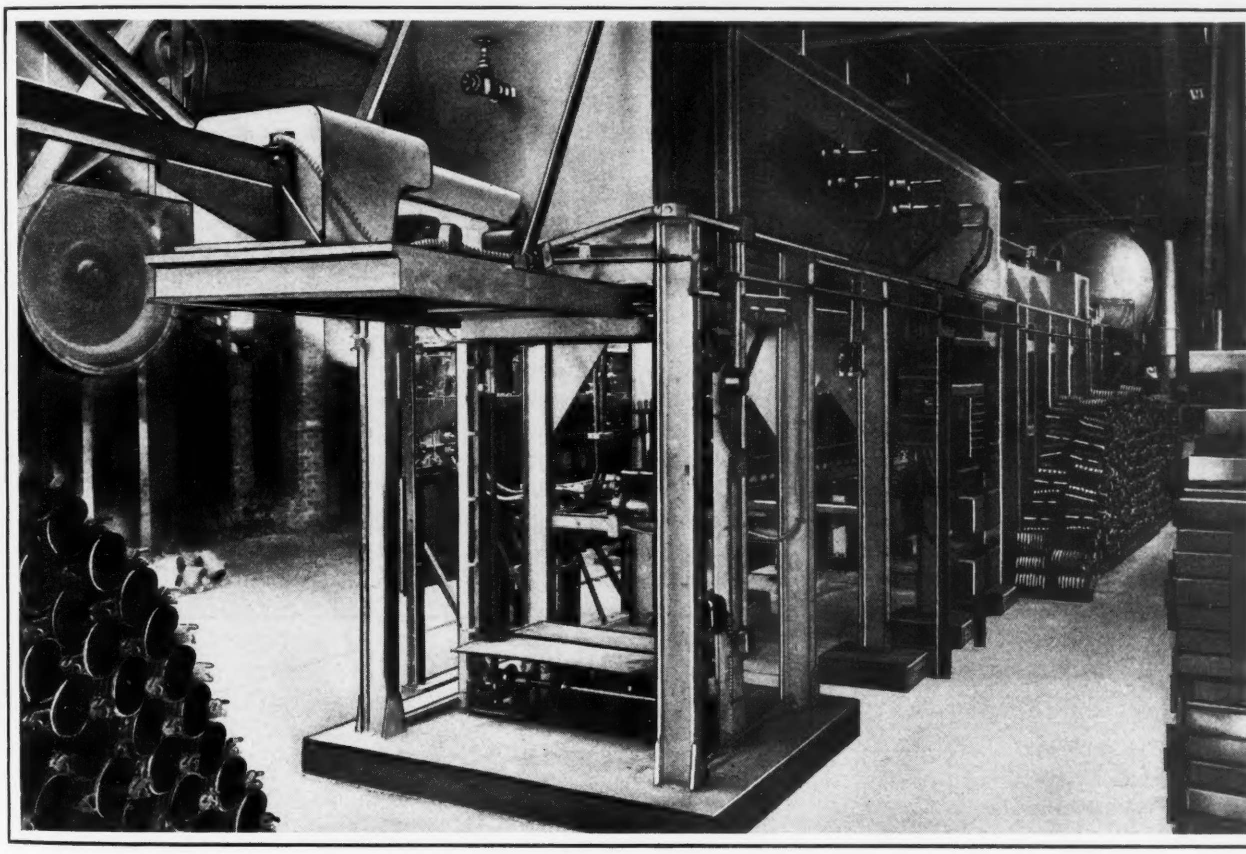


Fig. 1. Automatic Pusher-type Electric Furnace Used for Brazing Small Parts

Two outstanding advantages accompany this easily applied method of fabrication. The first is the fact that steel is annealed in the process, by slow cooling in the reducing atmosphere. In this connection, it might be stated that carburized parts may be subsequently hardened by observing certain precautions, and in general, heat-treating processes may be carried out successfully after

brazing, provided the temperatures used do not reach the melting point of copper.

The second advantage is that less pickling or cleaning is required. The work comes from the hydrogen furnaces bright, smooth, and clean, with no roughness at the joints or oxidation of the surfaces; in fact, the appearance of the parts is improved by the brazing operation, owing to the cleaning effect of the reducing atmosphere.

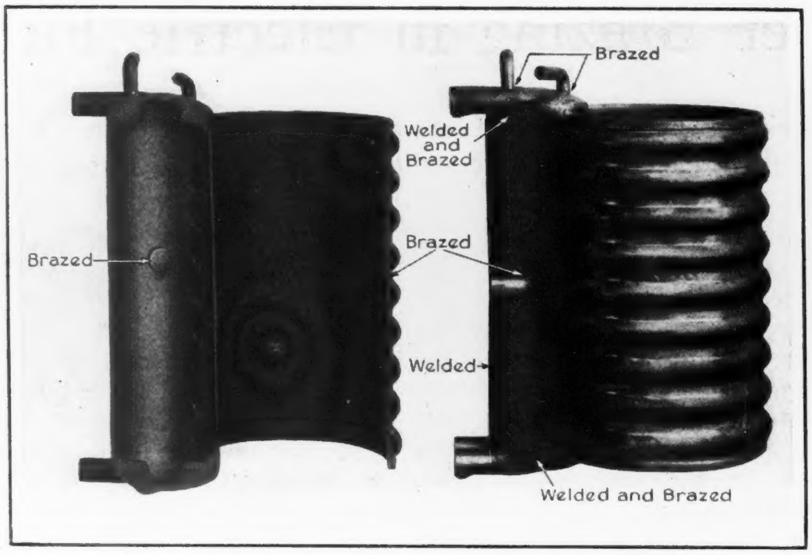


Fig. 2. Refrigerator Evaporator Fabricated from Rolled-steel Sheets by Brazing

Fig. 2 illustrates a refrigerator evaporator which has been fabricated by this method and the use of atomic hydrogen arc-welding. Two sheets of steel, pressed and rolled into shape as shown, are spot-welded at intervals to insure good contact between the adjoining surfaces to be brazed, and then arc-welded by the atomic hydrogen process at the seam and ends of the cylinder. During assembly, a copper wire is inserted in each of the openings illustrated in the sectional view, and copper, in wire or powder form, is applied adjacent to the other joints. Altogether, there are sixteen copper brazed joints in this one evaporator casing, all of them having been made during a single passage through the furnace. The sectional views in Figs. 2 and 3 have been retouched to indicate some of the brazed joints, since these are, as a rule, barely distinguishable even in polished sections.

Fig. 3 shows four smaller pieces which have been fabricated entirely by copper-brazing cast, drawn, or machined steel parts. The piece shown at *A* is made up of a cast-steel base, over which is pressed a drawn shell. This, in turn, is surmounted by a small assembly of drawn parts into which is brazed a short section of steel tubing for making external connections.

At *B* is shown a float of light-weight drawn steel, made of two sections brazed together at a sleeve joint around the middle. Through the center runs a tube which is brazed into the shell where it passes through the top and bottom, and a bushing is brazed into each end of the tube.

A small drawn shell of fairly heavy section is shown at *C*, into the top of which are brazed two pieces which were peened into place. This is a good example of an inexpensive method of making a tight fit. A tube is pressed and brazed into one of the bushings for making outside connections during the general assembly.

At *D* is a brazed plunger of mild machined steel. Parts of this kind can frequently be fabricated and

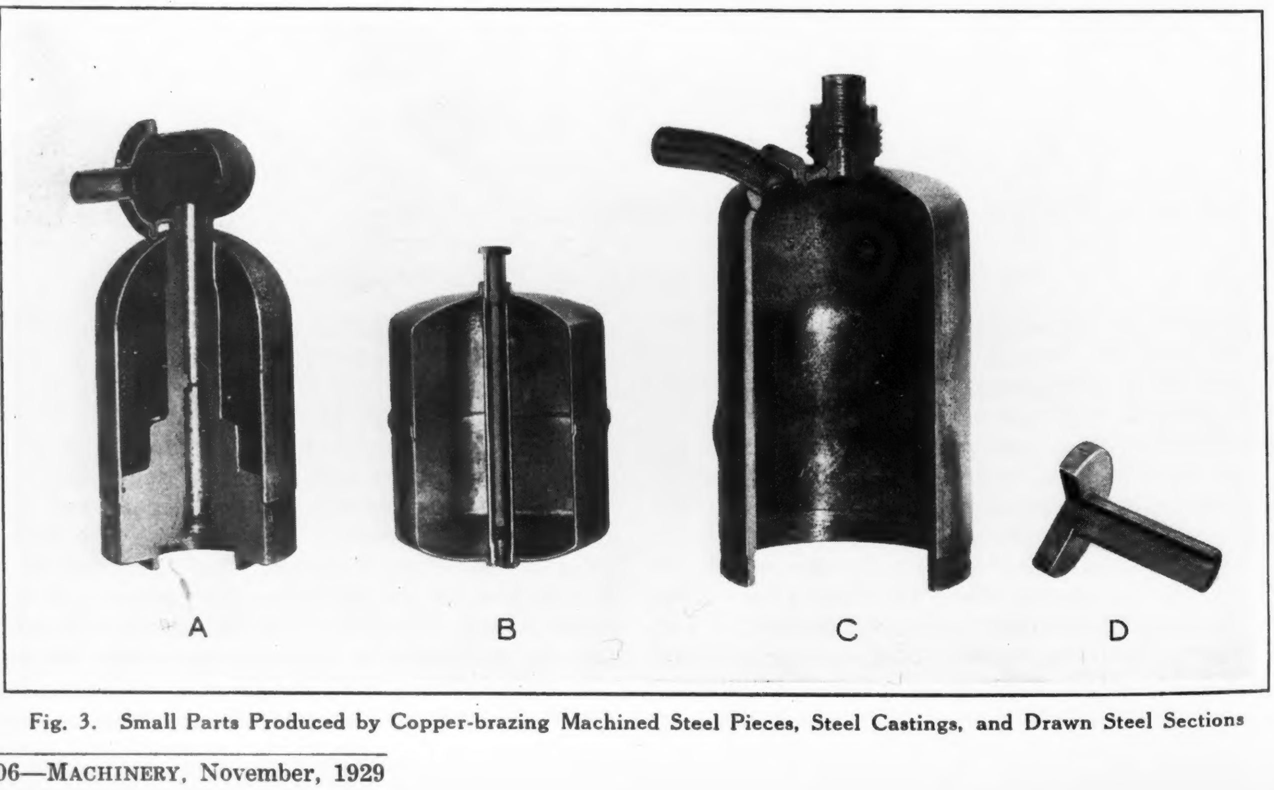


Fig. 3. Small Parts Produced by Copper-brazing Machined Steel Pieces, Steel Castings, and Drawn Steel Sections

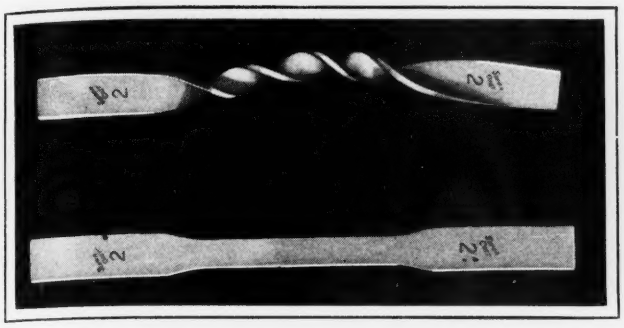


Fig. 1. Standard Test Bar Twisted through 850 Degrees without Developing Cracks

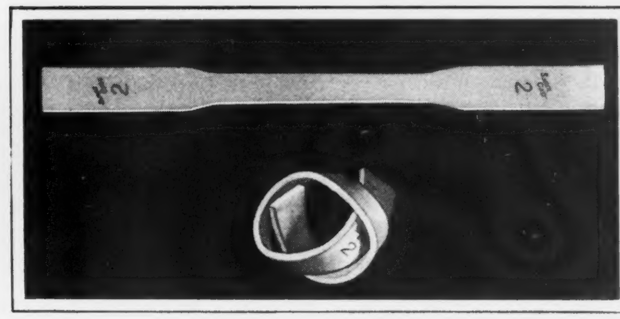


Fig. 2. Twisting the Test Bar as Indicated Causes No Checking or Cracking

brazed at less cost than they can be machined from bar stock, taking into consideration the cost of labor and the excessive waste of material.

Several different types of furnaces have been developed for copper brazing, the newest of which is the continuous automatic furnace, which requires but one attendant who loads and unloads the carriages as they pass along a conveyor. A 100-kilowatt, 125-volt automatic pusher-type furnace of this style is shown in Fig. 1, which is designed to braze small parts such as those shown in Fig. 3. The heating chamber of this furnace is 12 feet long, and the cooling chamber 22 feet long.

The carriages are lifted into the heating chamber from the loading conveyor by means of an elevator, and are pushed through the heating chamber and into a cooling zone, at the end of which is another elevator which automatically lowers the carriages from the furnace to the loading conveyor. A hydrogen atmosphere is maintained within both chambers of the furnace. The ribbon resistor units are mounted on the side walls and floor of the heating chamber, and a steel jacket surrounds the cooling chamber with inlets and outlets for the circulation of water.

Because this article deals with small refrigerator parts, it should not be assumed that copper brazing is limited to objects of small dimensions. On the contrary, heavy turbine diaphragms composing unit charges of six or seven tons have been successfully brazed for the last six years, and steam plates ranging in sizes up to 38 by 74 by 2 1/2 inches have been fabricated on regular production schedules in batch type furnaces for a similar period.

DIE-CASTING ALLOY OF GREAT STRENGTH

In May, 1927, MACHINERY, an illustration was shown of a standard test bar made from a zinc-base die-casting alloy which had been twisted through 240 degrees without showing any signs of cracking. This die-casting alloy had been developed by the Superior Die Casting Co., Cleveland, Ohio. In October, 1928, MACHINERY, a further improvement in this die-casting alloy was referred to and an illustration shown of a zinc alloy test bar twisted through 320 degrees. The zinc-base alloy referred to is known as "SuperCast Alloy No. 2."

Since that time, further improvements have been made in this alloy by the Superior Die Casting Co. with the aim of producing a material that would combine high tensile strength with unusual ductility and permanency. Fig. 1 shows a test bar of the standard 1/2- by 1/8-inch cross-section that has been twisted through 850 degrees without checking or cracking. The tensile strength of the alloy ranges from 45,000 to 51,000 pounds per square inch, with an elongation of 5 per cent. It is also stated that the new alloy possesses about 25 per cent greater permanency when subjected to an accelerated steam test than the alloy formerly described. Fig. 2 shows an interesting example of how a test bar may be twisted without cracking.

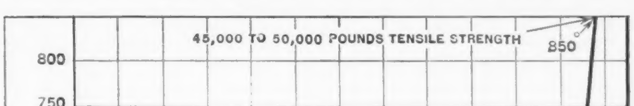


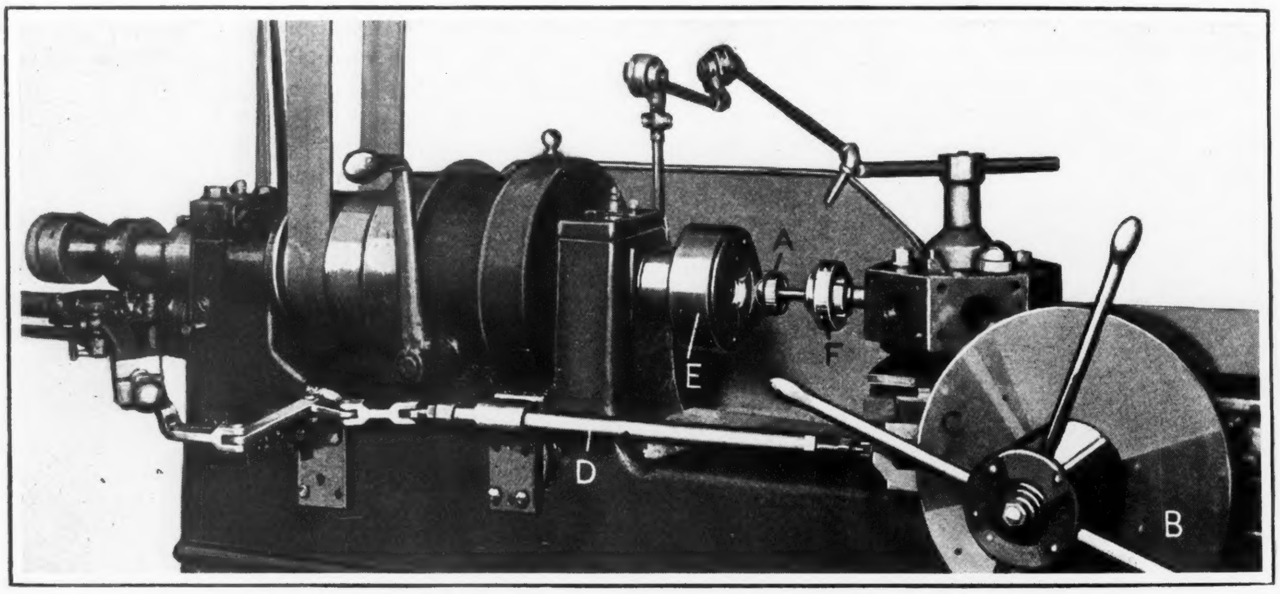
Fig. 3. Successive Steps in Developing the SuperCast Die-casting Alloy

Some of the applications of this alloy are found in gears for electric motor drives, in gasoline pumps, and shock absorber parts. It is especially recommended where resistance to impact is an important factor. The chart reproduced in Fig. 3 indicates the progressive steps in the development of this alloy.

FAST-LOADING ARRANGEMENT ON A SCREW MACHINE

A screw machine equipped as illustrated gives unusually high production at the plant of the Alemite Corporation, Chicago, Ill., in an operation on small steel stampings. These stampings, one of which may be seen at *A*, are approximately 2 inches in diameter by 1 inch long. They are open at one end and dome-shaped at the other. The operation consists of facing the open end to length and chamfering this end, both inside and outside.

The production averages 1020 finished pieces per hour, whereas the output of the same machine before applying the special equipment was 400 pieces per hour. The special equipment consists of a fast loading device, automatic mechanism for opening and closing the collet chuck, and a cam feed for the turret-slide. The cam consists of a groove cut in the rear side of plate *B* which is revolved by turning spider *C*. This cam is engaged by a roller mounted on the turret-slide. Rod *D*, which actuates the regular collet opening and closing mechanism, is connected to the turret-slide.



Screw Machine Specially Equipped for Facing and Chamfering 1020 Small Stampings per Hour

In starting to machine one of the stampings, the operator places it, as shown at *A*, on a bar having a head that is shaped to fit the inside of the stamping. Then, the operator turns spider *C* to feed the turret-slide forward and advance the work into the cavity of chuck *E*. As the operator continues turning spider *C*, rod *D* actuates the system of levers at the left-hand end of the machine, closing the collet on the work through the regular mechanism. Next, cutter-head *F* brings three tools into contact with the revolving work to take the cuts mentioned.

Then, as the operator still keeps turning spider *C* counterclockwise, the turret-slide roller reaches a low point on the cam groove, which causes the movement of the turret-slide to suddenly be reversed, thus quickly withdrawing the cutter-head and loader from the work; at the same time, rod *D* is jerked toward the right, which opens the collet. Immediately afterward, an ejector pin within the collet discharges the work into the pan of the machine.

* * *

LARGE ENGINEERING LABORATORY PLANNED FOR DETROIT

What is planned to be the world's largest engineering laboratory will be erected in Detroit during the coming year, according to an announcement made by MacDonald Bros., Inc., production engineers with offices in Boston, New York, Chicago, Cleveland, and Charlotte, N. C. The company operating the new laboratory will be known as MacDonald Bros. Engineering Laboratories, Inc. The laboratory will be located not far from the Highland Park Plant of the Ford Motor Car Co. It will be of steel and concrete construction, six stories in height, and will have more than 500,000 square feet of floor space.

In addition to the laboratory itself, where tests on all kinds of machinery may be undertaken, space will be provided for the display of machinery and provisions made so that the machinery may be demonstrated under actual working conditions. It is believed by the sponsors of this undertaking that the laboratory will be of great assistance to the manufacturing industries of the United States and that it will aid in the solving of many complicated problems. The idea is to make it possible for a buyer of machinery to find all that he needs under one roof, operating under working conditions.

* * *

According to *Aeronautical Engineering,* in 1919, 622 airplanes were produced in the United States; in 1921, 302 planes; 1923, 587 planes; 1925, 789 planes; 1926, 1186 planes; 1927, 1962 planes; 1928, 4000 planes; and for 1929, a production of 12,000 planes is estimated.

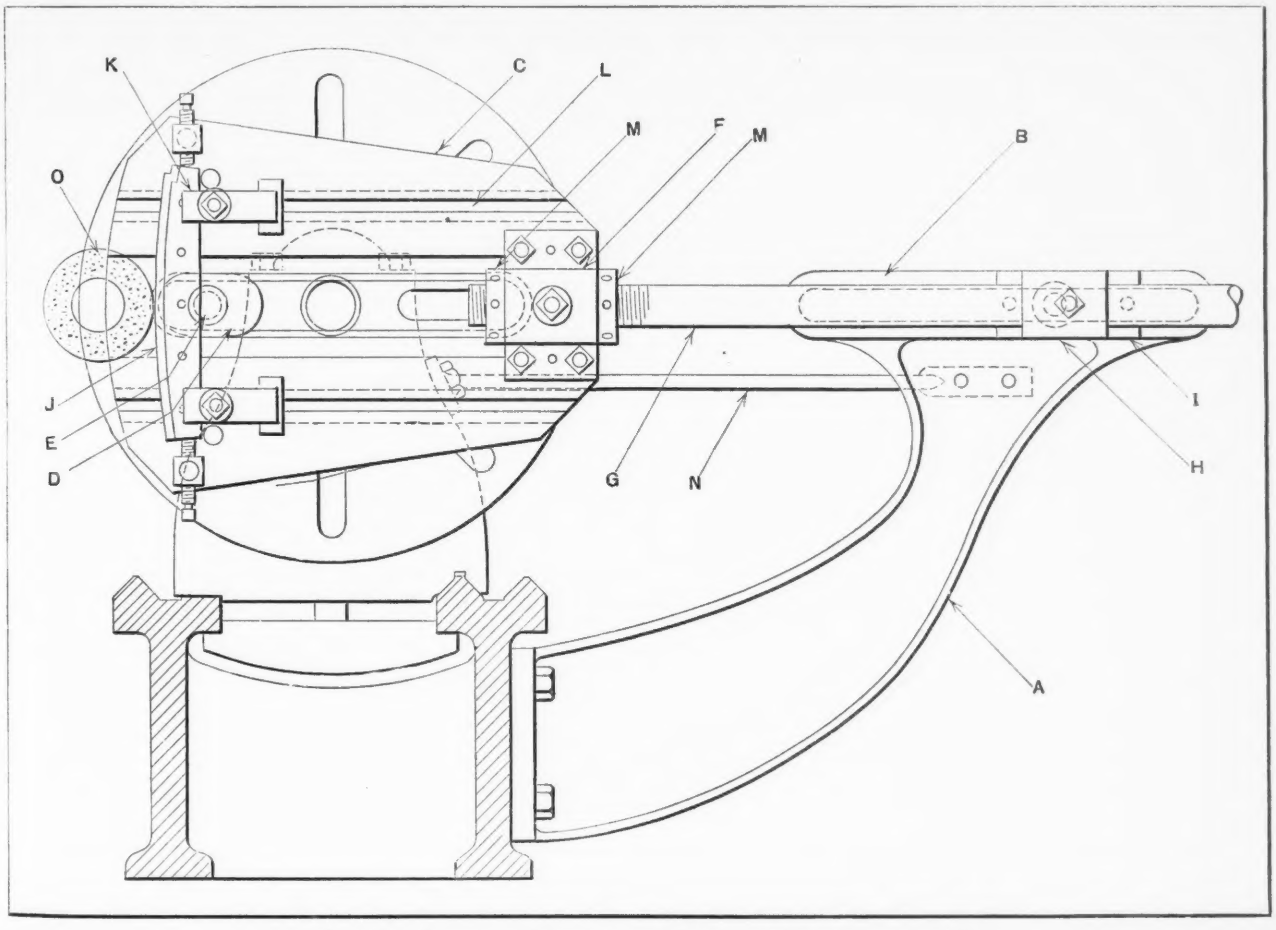
Letters on Practical Subjects

TURNING AND GRINDING DIE SECTIONS OF LARGE RADII

In making large blanking dies for the tapering bodies of tubs, pails, dishpans, etc., the upper and lower edges often form arcs of such large radii that it is difficult to machine them in the ordinary way on any available tool in the shop. The usual custom is to lay out the work and machine to the arc by means of a shaper, vertical slotter, or milling machine.

A lathe attachment that should prove serviceable to the shop engaged in this class of work, and that may be applied with slight modifications to the boring mill or planer, is shown diagrammatically in the illustration. The work, with the attachment, oscillates about a point on a stationary outboard arm *A*, and receives its motion from a sliding block *D* attached to the revolving machine faceplate at the proper distance from the spindle center. Arm *A* is firmly bolted to the bed of the machine, with the front face of the upper end *B* in the same plane as the faceplate or table of the machine. The workplate *C* is provided with a central slot in which the block *D* slides. Block *D* is held in a predetermined position on the faceplate by the adjustable stud *E*, which is located in a drilled hole in the faceplate.

On the rear end of plate *C* is located a bracket *F* which supports one end of the radius shaft *G*. The adjustable block *H* is secured on the shaft by set-screws, and is provided with a short stud that



Lathe Attachment for Turning and Grinding Dies of Large Radii

passes through a bearing in the locating block *I*, the latter being adjustable along the arm at *B* and held in position by two short bolts. This arrangement permits the attachment to be set for the different radii to be machined.

The section of the blanking die *J* is held in position by means of the straps *K*, parallel T-slots *L* being provided for the strap bolts. The final radial setting is obtained by means of the two adjustable lock-nuts *M*. The rod *N* gives added rigidity to arm *A*. A dirt guard (not shown) for the faceplate mechanism is provided to protect the block and slide from chips or emery when wheel *O* is used to finish the hardened block.

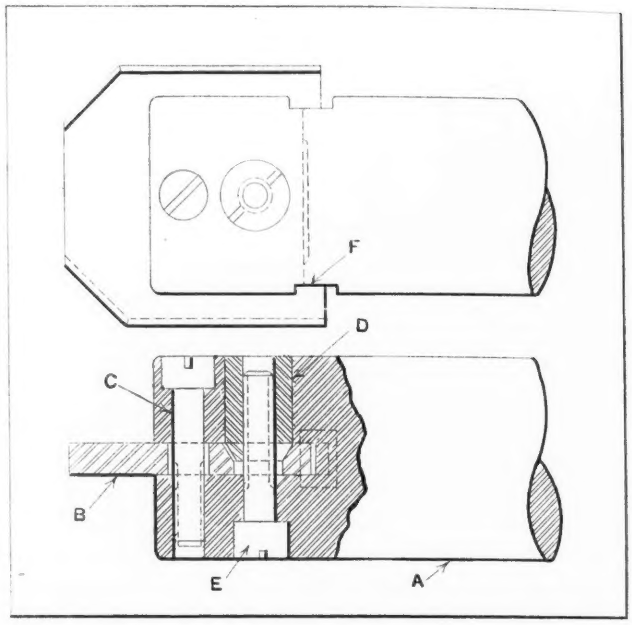
To prevent the rubbing of the work on the heel of the turning tool as the former oscillates, a special clapper box is used in place of the regular toolpost. When work of longer radii is machined, an extension piece may be fastened at *B*. For a fixture of this kind, it is advisable to use a gap lathe, as when the faceplate revolves, plate *C* may drop below the shears of an ordinary lathe. In the case of the mill or planer, this interference will not be encountered.

JIM HENDERSON

RIGID METHOD OF HOLDING CUTTER IN BORING-BAR

A method designed by the writer for holding cutters in boring-bars is shown in the accompanying illustration. One of the outstanding features of this design is its rigidity. Another advantage is that the cutter can be removed when it is necessary to regrind it, and replaced without altering the original setting.

The cutter *B* is a slip fit in a slot milled through the end of the bar *A*. The bushing *D* is also a slip fit in the bar, the lower end being tapered. The cutter is held solidly against the bottom of the slot through the action of the screw *E*, which forces the tapered end of bushing *D* against the side of the tapered hole in the cutter. The hole in the cutter is slightly offset from that in the bar, so that only one side of the taper on the bushing is in engagement with the cutter. Two projecting ears on the cutter are a slip fit over the flats *F* in the bar, thus centralizing the cutter. After tightening screw *E*, the screw *C* is tightened, so that both sides of the bar grip the cutter.



Rigid Method of Holding Cutter in Boring-bar

Fairfield, Conn. F. E. JUDSON

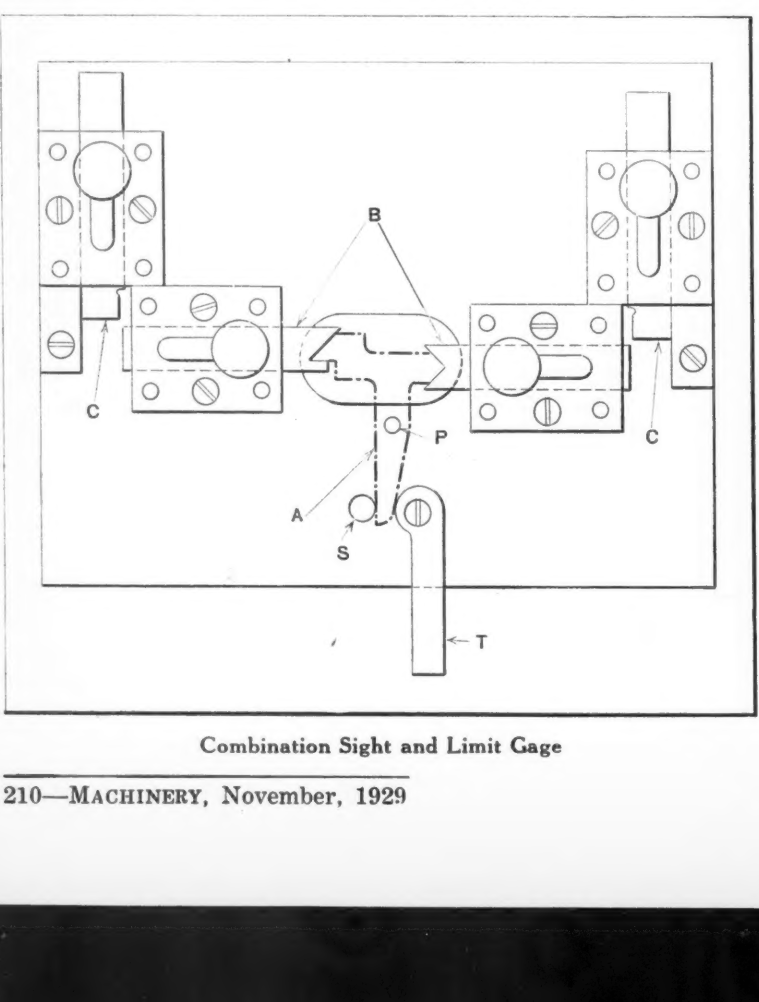
COMBINATION SIGHT AND LIMIT GAGE

The combination sight and limit gage shown in the accompanying illustration is used for gaging the small pawl *A* indicated by heavy dot-and-dash lines. The relationship between the center hole, the projecting end, and the two milled or beveled ends of the piece is tested with this gage.

First, the pawl is located on the center pin *P*, and the projecting end brought up against a stop-pin *S*. The small cam-lever *T* is used to press the projecting end against the stop-pin. The two intermediate slides *B* are then brought forward until they come in contact with the milled ends of the pawl, after which the accuracy of the machined work is gaged by the two limit slide gages *C*.

An opening in the base of the gage directly beneath the milled ends of the pawl permits the inspector to compare the profiles of the milled ends with those of slides *B*. This comparison is made by holding the gage up to the light.

New Britain, Conn. SVEND J. HELWEG



Combination Sight and Limit Gage

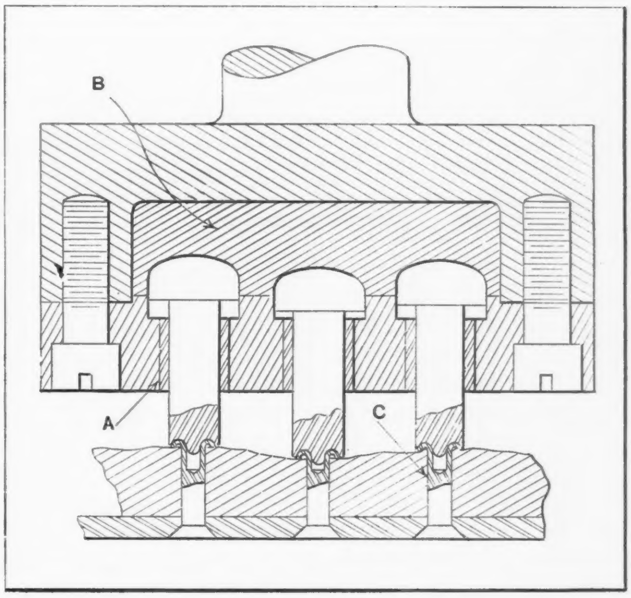
COMPENSATING HOLDER FOR MULTIPLE RIVETING PUNCH

When a punch press is used for setting several rivets simultaneously, difficulty is sometimes experienced in obtaining uniform riveting, owing to irregularities in the surfaces of the parts assembled, variations in their thickness, or variations in the lengths of the rivets. In the accompanying illustration is shown a multiple punch-holder designed to overcome this trouble. The rubber pad shown at *B* serves to equalize the pressure exerted by the punches, and thus insures uniform setting or heading of the rivets *C*.

With this construction, the first punch to make contact with the rivet recedes through its bushing *A*, while the large head presses into the rubber pad *B*. Pad *B* acts as a filler in much the same way as a fluid, and presses outward against the heads of the remaining punches, causing them to advance and head over the rivets with a uniform pressure. Thus the entire punch assembly acts like a solid punch when the individual punches are all in contact with the work.

In designing a punch of this kind, it is well to bear in mind that the punch-heads act as pistons, and may cause the rubber filler to develop a pressure which may easily amount to several thousand pounds per square inch. Roughly, other conditions being equal, this pressure will be in inverse proportion to the size of the punch-heads. It is, therefore, important that the punch-heads be made as large as convenient and that the rubber chamber be designed to resist a high internal pressure in order to avoid failure while in operation.

In assembling the punch-holder, care should be taken to see that the rubber pad does not entirely fill the available space. A small clearance should be allowed, as otherwise, the first punch to encounter the work would be unable to recede and the compensating feature would be lacking.



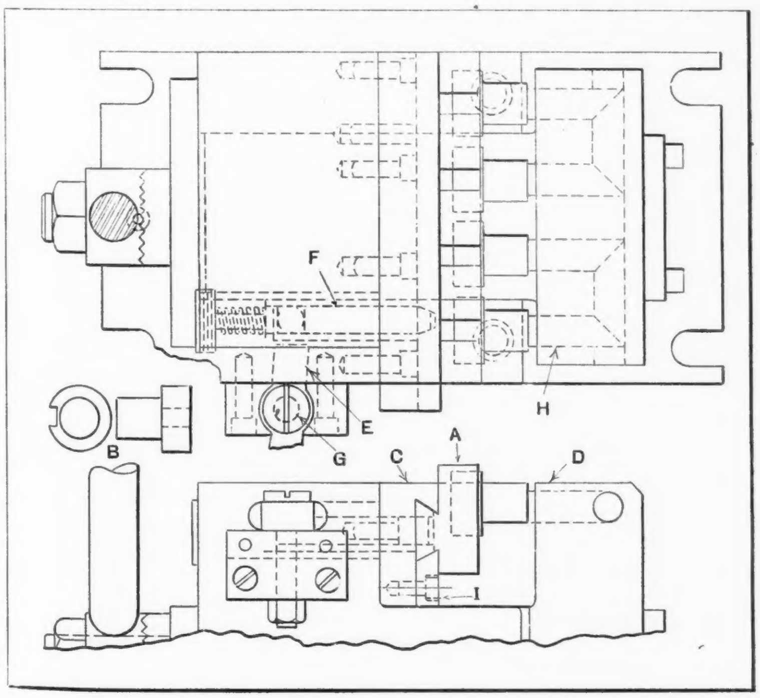
Multiple Punch-holder Provided with Equalizing Rubber Pad

Rochester, N. Y. — ERNEST C. ALLEN

MILLING MACHINE VISE EQUIPPED WITH MAGAZINE CLIPS

A milling machine vise, equipped with magazine clips *A*, is shown in the illustration. Two of these clips, for holding the pieces shown at *B* while slotting, are provided, one being loaded while the other is in operation. They are a sliding fit in the stationary jaw *C*, and located in the latter by the spring-actuated indexing pin *F*, one end of which has two angular faces that engage a corresponding vertical slot in the clip. This arrangement eliminates any interference when the gib *I* is adjusted.

The indexing pin is operated by the hand-lever *E* pivoted at *G*. The movable jaw *D* is equipped with equalizing pins *H*, and has sufficient side play to permit an equal pressure on all four pieces to be milled. In operation, the indexing pin is withdrawn by lever *E*, and the clip with the finished pieces is forced from the vise by a freshly loaded clip, thus preventing the collection of chips in the dovetail slide.



Milling Machine Vise Equipped with Magazine Clips

Newton, Iowa — GEORGE WILSON

WAGE AND EFFICIENCY RECORD

One of the problems affecting good will between management and employes is the handling of raises; if not handled systematically, a high labor turnover may be the result. To prevent this, one firm has inaugurated a system under which the name of each employe that is hired is recorded on a card, Fig. 2, of a filing index kept in

RECOMMENDATION FOR WAGE OR SALARY INCREASE

EMPLOYE John Dunn OCCUPATION Toolmaking

FOR PERIOD ENDING Jan. 22, 1929

PRESENT RATE	RECOMMENDED RATE	GRADE	REMARKS
90 ¢	95 ¢	A	Continues as fast worker
DEPT. HEAD'S SIGNATURE Fred Dover			

Fig. 1. Card that is Sent to Foreman to be Filled in Every Six Months

the superintendent's office. At the end of every six-month period, a slip like that shown in Fig. 1 is sent to the foreman of the department in which the man works.

The foreman fills out this slip, recommending a wage increase, if warranted, and adds a grade letter to designate the quality of the employe's workmanship. These grade letters run from A to E, grade A being excellent; B, very good; C, good; D, fair; and E, not suited to the work. After this slip has been filled out, it is returned to the superintendent's office where the information is transferred to the file card. If a raise has been recommended, the file card is turned over to the superintendent for final O.K., and, if approved, notice is given to the paymaster to pay the new rate.

Every employe in the plant is represented by a card similar to the one shown in Fig. 2. The cards are placed in the file according to calendar dates; and each day the first card or group of cards in the index with the date at the upper right-hand corner corresponding with the date of that day, is removed from the file and filled out from the information given on the slip already described. After being passed upon by the superintendent, the card is put back in the file according to the other period date in the upper right-hand corner. This card, then, will come to the front in another six months.

In this manner, the employe knows that if he is considered a good worker, and business conditions permit it, he will receive an increase at definite intervals. When the employe has reached the maximum wage, he will not, of course, expect further increases. By regulating wage increases in this way, an incentive is created for the man to improve his work in order to be in line for a raise at the end of the next period.

This system serves another purpose also, as it furnishes a brief record of the employe's general standing as a workman. If the latter leaves the company, his card is removed from the file and placed in a "dead" file, indexed under the employe's name, thus furnishing a future reference in case he again applies for a job.

Glen Ridge, N. J. J. E. FENNO

EQUALIZING STRAINS IN GEAR-CUTTING

Although gear-cutting in manufacturing shops is done largely by hobbing and generating methods, a good deal of work is still done with formed cutters that produce one tooth at a time as the blank is indexed. This method is the common one in contract

EMPLOYE John Dunn PERIOD DATE Jan 22
" " July 22

DEPT. HEAD Fred Dover DEPT. 46 OCCUPATION Toolmaking

ENTRANCE RATE 62 ¢ ENTRANCE DATE July 22/29

PERIOD ENDING	RECOMMENDED RATE	GRADE	SUPT'S SIGNATURE	PERIOD ENDING	RECOMMENDED RATE	GRADE	SUPT'S SIGNATURE
Jan 22/23	65 ¢	C	E. Gray	July 22/28	90 ¢	B	
July 22/23	68 ¢	C	E. Gray	Jan 22/29	95 ¢	A	E. Gray
Jan 22/24	70 ¢	C	E. Gray	July 22/29			
July 22/24	75 ¢	C	E. Gray	Jan 22/30			
Jan 22/25	78 ¢	C	E. Gray	July 22/30			
July 22/25	80 ¢	B	E. Gray	Jan 22/31			
Jan 22/26	80 ¢	C		July 22/31			
July 22/26	80 ¢	C	E. Gray	Jan 22/32			
Jan 22/27	83 ¢	B	E. Gray	July 22/32			
July 22/27	87 ¢	B	E. Gray	Jan 22/33			
Jan 22/28	90 ¢	A	E. Gray	July 22/33			

Fig. 2. Wage and Efficiency Record Card

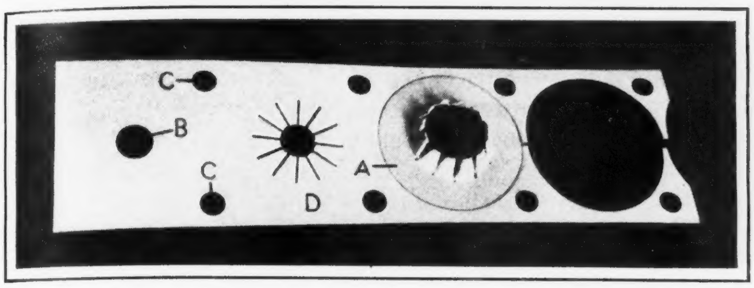


Fig. 1. View of Fiber Stock Showing Operations Performed in Three-step Die

and jobbing shops. A departure from the usual procedure, which can often be followed to advantage when using a formed cutter, is the segmental method of indexing.

Instead of starting at a given point and continuing entirely around until the gear is complete, the segmental method consists of cutting a portion of the teeth in one spot, then skipping to the opposite side and doing the same thing, and repeating this at several points between.

This method is used in the shops of the Morse Chain Co., Ithaca, N. Y., where large cast-iron sprockets are all cut in this way. Rows of teeth totaling about one-tenth of the whole number are cut at intervals around the rim, after which the blank sections are completed.

Cast iron, unless it has had the equivalent of a year's seasoning, awaits eagerly every chance to change its shape. In gear-cutting, this change shows up in circumferential and radial movements. The man who finds he has a thin tooth at the end of the run is likely to blame the indexing mechanism, whereas the fault lies in cumulative released strains, and a further inspection may easily show that the gear is lopsided too. It is to equalize these strains that segments are cut at selected points around the periphery.

In the case of a sprocket, inaccuracy does not seem so serious a matter as with a gear, but this company finds that the extra cost of segmental cutting is warranted because when this is done, the sprockets give better performance and have longer life.

D. A. H.

PIERCING AND FORMING DIE FOR FIBER PARTS

The three-step progressive die described in this article is of rather unusual design in that four operations are performed at each stroke, including a forming operation and a slitting operation in which inserted-blade punches enter a wood block (made from lignum vitae) on passing through the fiber part. One of the completed fiber parts is shown at *A*, Fig. 1, in the scrap stock just as it appears after being blanked and formed.

These pieces, one of which is formed at each stroke of the press, serve as spool heads for electromagnet bobbins or coils. Two spool heads, connected by a gummed paper sleeve which slips over the slotted ends that are formed into a flange, complete the spool. The fiber stock from which the spool heads are made is 0.025 inch thick by 1 3/4 inches wide.

The stock enters the die shown in Fig. 2 at the right-hand side. On the first stroke of the press, the stock is fed just far enough to permit the punches *B* and *C* to pierce the holes *B* and *C*, Fig. 1. The stock is then moved to the left to permit the pilots *D* to enter the previously pierced holes *C* and thus accurately align the work directly under the slitting punch *E*. On the second stroke of the press, the twelve blades of punch *E* slit the stock, as indicated at *D*, Fig. 1.

For the third and final stroke of the press, the end of the stock is located against the stop *F*. As the ram of the press descends, the punch *G* blanks out the part, and continuing its downward movement, forces the work over the forming punch *H* which forms or bends the slotted segments, as shown at *A*, Fig. 1. The pressure ring *I*, Fig. 2, holds the stock firmly in place against the end of the blanking punch on the downward stroke, and

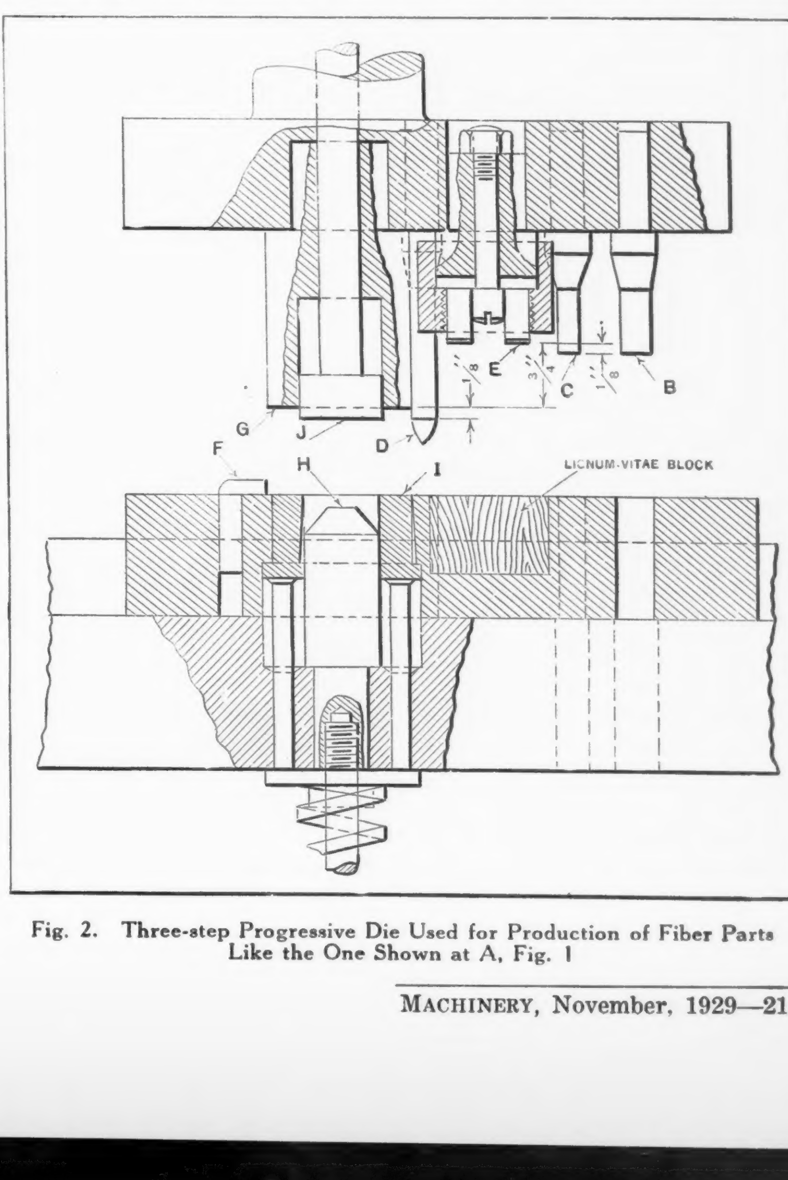


Fig. 2. Three-step Progressive Die Used for Production of Fiber Parts Like the One Shown at A, Fig. 1

on the upward stroke forces the completed part up into the opening in the stock. When the stock is moved along to the next position, the stop *F* ejects the piece *A* from the scrap. The knock-out *J* is provided to prevent the part from adhering to the punch *G*. Although not shown in the illustration, a stripper plate 1/8 inch thick extends from the right-hand side of the die to a point just beyond the clearance holes for the pilots *D*.

Perhaps the most interesting feature of the die is the construction of the slitting punch. It consists of twelve slitting blades like the one shown at *E*, Fig. 3, a slotted shank *D*, and a retaining collar *B*. The end view of the shank or blade

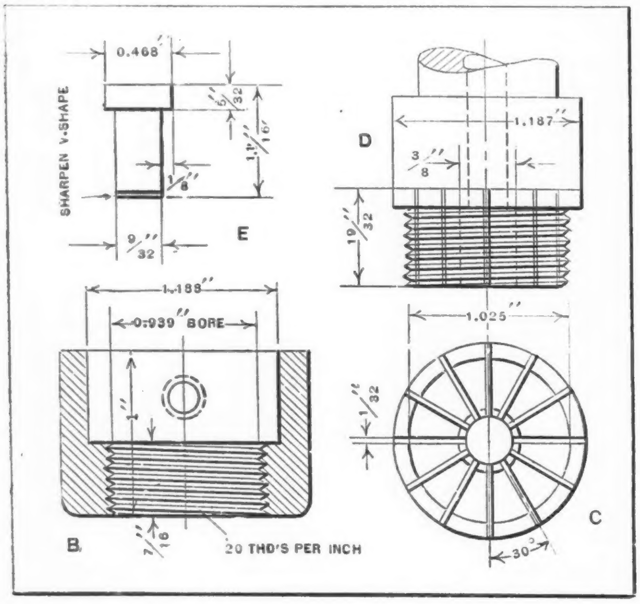


Fig. 3. Details of Slitting Punch Used in Die Shown in Fig. 2

holder is shown at *C*. The manner in which these members are assembled is shown quite clearly in Fig. 2.

Adrian, Mich. FRANK V. KEIP

SHOULD TOOL DESIGNERS MAKE THEIR OWN DRAWINGS?

In an article in May MACHINERY, page 680, it is stated that "tool draftsmen are not divided into design and detail men to the same extent as formerly." I am sorry to say that this statement is correct, as I do not consider it any improvement. Years ago, if it became known that a firm was looking for tool designers, only the more experienced men applied for the job, and if ordinary draftsmen or detailers were wanted, there were the younger and less experienced men to fill the positions at less pay.

The writer has had fifteen years' experience in charge of drafting-room work, including the hiring of draftsmen and the supervising of tool designing. He has found that today, if an advertisement, "Tool designer wanted," is inserted in a local paper, nine out of every ten answers will be likely to be from men not over twenty-five years of age. Usually, the majority of these men are floaters and their only object in answering an advertisement is the prospect of obtaining "just another job" or a job which will give them a slight increase in pay. Such men are always ready to leave at the first opportunity that presents itself.

They are unconcerned as to their ability to meet the requirements and they figure, and quite correctly too, that once they have been hired and have started on the job, the company will put up with them for a while rather than go to the trouble of looking for another man to fill the place.

A tool designer working for a small concern employing only a few draftsmen will, of course, do all his own detail work, but I believe that concerns having a large tool-drafting force would profit by dividing their men into two classes—designers and detailers. By so doing, the quality of the work will be improved, the drafting-room expense will be lowered, and the younger men will receive a more thorough training.

Let us now consider the effect on the quality of the work. If the tool designer is an experienced man, it is only necessary to give him a general outline of the various operations on the work, as planned, and state the kind of tools to be designed and which machines are to be used for the job. With this information, the designer can carry the work along without any further assistance. Only in very rare cases will it be necessary to go into the details of the design with men who are actually designers.

A designer should make his lay-outs to scale, furnish the important dimensions, and give enough information to enable a less experienced man to draw the details. However, the designer himself must check all the details before any drawings are sent into the shop.

If, on the other hand, younger and inexperienced draftsmen are employed for tool designing, it will not only be necessary to spend considerable time in checking their drawings, but it will also be necessary to provide fairly complete sketches of the details before the men can go ahead with the work. Even then, their work must be closely watched if satisfactory results are to be obtained.

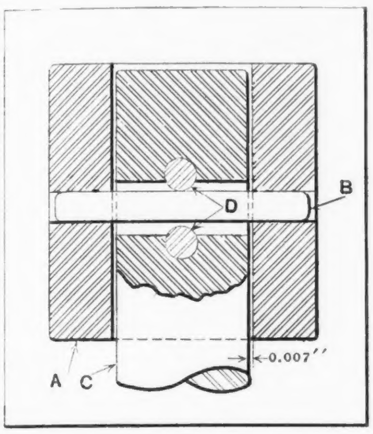
If the older and more experienced tool designers are allowed to do all their own detail work, the drafting-room costs will be greater than if less experienced draftsmen are given the detail work under the supervision of the designers who, of course, are held responsible for the work. By dividing up the work in this way, the designer will have more time for his lay-out work, and as a result, will do more and better work at less cost.

As the younger men gain experience and become familiar with the work handled, it is possible to draw on them to fill the vacancies that occur in the designing force from time to time. Then, again, there is no better way for a young draftsman to obtain a thorough and practical training than by starting with detail work. By doing the detail work for an experienced tool designer, he will learn more about tool designing in a given time than he would by working alone. S. J. H.

Shop and Drafting-room Kinks

FLOATING REAMER-HOLDER

A reamer-holder of a type designed to give an easy floating action to the reamer is shown in the illustration. In the turret bushing *A* is driven the hardened drill-rod pin *B*, which passes through a clearance hole in the reamer shank *C*. To give a one-point bearing that would not restrict the side play of the shank, the two pins *D* were used. It is obvious that with this design the method of taking the thrust is the same both when the reamer enters and leaves the hole. This holder is now being used successfully on boring mill work.

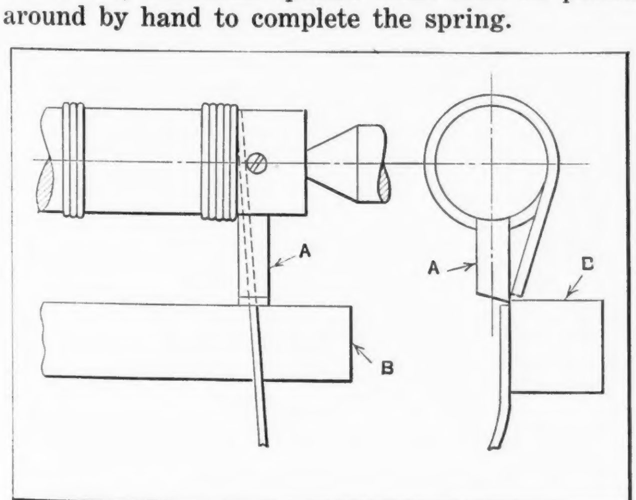


Floating Reamer-holder Having a One-point Thrust Bearing

Glen Ridge, N. J. J. E. Fenno

CUTTING-OFF TOOL FOR SPRING-COILING ARBOR

When winding coil springs in the lathe, the writer has often found it awkward to cut off the wire at the end of the coil. A pair of cutting pliers is generally used for this work. When the tension is released by cutting the wire, the cut end springs back or revolves rapidly and may cause trouble. Another objection to cutting the wire by hand is that the lathe must be stopped before the last few turns are wound to avoid making the coil too long. Of course, the lathe spindle must then be pulled around by hand to complete the spring.



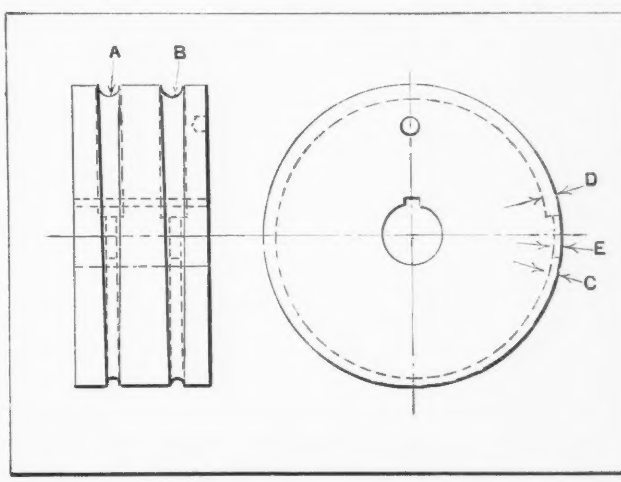
Spring-coiling Arbor with Cutting-off Tool

If a large number of springs is to be made, it is a good plan to provide the arbor with a lathe tool such as shown at *A* in the illustration. An ordinary solid tool *B* placed in the toolpost and brought up into the position shown, completes the cutting-off tool. With the arbor gripped in the chuck and supported at the outer end by the center, the spring can be wound complete without stopping the lathe. When the coil reaches the required length, the wire is cut off by slipping it beneath the cutting end of the revolving tool *A*.

Hamilton, Ontario, Canada H. Moore

A CONVENIENT FLY-CUTTER HOLDER

The cutter holder shown in the illustration, which is more flexible in some respects than the ordinary fly cutter, was designed by the writer. It is used on the regular cutter-arbor of a milling machine. The holder is of cold-rolled steel with a center hole of 1-inch diameter fitting a standard 1-inch milling machine arbor. Four holes are drilled and reamed in the holder as shown, ranging from 1/2 to 7/8 inch, in order to accommodate four different sized cutters. The cutters are made of drill rod of the most convenient size for the particular job in hand, and are held in place by set-screws.



Fly-cutter Holder, of Economical Design, Used on Standard Milling Machine Arbor

The advantages of this type of holder are as follows: It is cheaper to make; it gives a choice in the size of steel from which to make the cutter; it is as flexible as a regular milling cutter, because it fits the same arbor; and the roughing of the job can be done with a regular cutter, after which the change to the form fly cutter can be made with less trouble than when a regular fly cutter is used.

Cleveland, Ohio C. H. Hays

Questions and Answers

PITCH RADIUS OF INTERNAL GEAR

L. S.—In the accompanying diagram, ab and cd are the radii of the pitch circles of two gears which mesh with an internal gear. A method of calculating the radius bh of the pitch circle of an internal gear that will be tangent to the pitch circles of the two gears is desired. The known values are as follows: $ae = 4.500$ inches; $ab = 1.125$ inches; $ef = 1.500$ inches; $cf = 2.200$ inches; and $cd = 0.750$ inch.

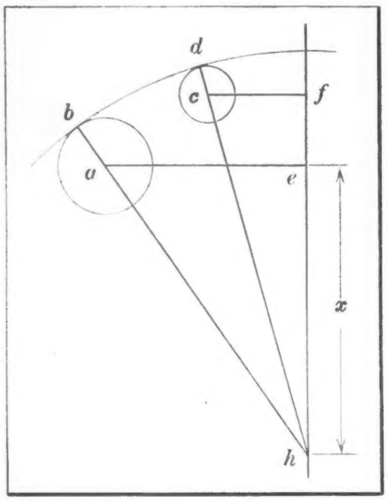


Diagram Used in Calculating Radius of Pitch Circle

Answered by E. Simonsen, Cincinnati, Ohio

Referring to the diagram, we have

$$bh = \sqrt{x^2 + ae^2} + ab$$

Also,

$$dh = \sqrt{(x + ef)^2 + cf^2} + cd$$

Now, as bh and dh are equal we have

$$\sqrt{x^2 + ae^2} + ab = \sqrt{(x + ef)^2 + cf^2} + cd$$

Substituting numerical values, we have

$$\sqrt{x^2 + 4.5^2} + 1.125 = \sqrt{(x + 1.5)^2 + 2.2^2} + 0.75$$

Simplifying this equation, we have

$$-8.4375x^2 + 79.8036x - 165.5082 = 0$$

This equation, which is now in the form $ax^2 + bx - c = 0$, may be solved by employing the well-known formula for quadratic equations,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Substituting the given values, we have

$$x = \frac{-79.8036 \pm \sqrt{79.8036^2 - 5585.9018}}{-16.8750} = 6.3877$$

Now, substituting numerical values in the formula

$$bh = \sqrt{x^2 + ae^2} + ab$$

we have,

$$bh = \sqrt{6.3877^2 + 4.5^2} + 1.125 = 8.938 \text{ inches}$$

DEPOSIT FROM SOLUBLE OIL

M. R.—The accumulation of a deposit on the blade of a power hacksaw has recently given us considerable trouble. This gummy or oily deposit interferes with the flow of the cutting compound and the removal of chips from the cut. Apparently, some constituent of the soluble oil from which the cutting emulsion is made does not stay in suspension and is deposited on the blade. We would like to know what the composition of this gummy substance is and what steps should be taken to prevent its deposition on the hacksaw blade. The blade is of 16-gage steel, 17 inches long by 1 inch wide, and has ten teeth per inch. The machine has a stroke of 6 inches, and runs at a speed of 120 strokes per minute.

Answered by H. L. Kauffman, Denver, Colo.

This is a trouble that others have experienced in the use of soluble oil. The substance deposited on the blade of the hacksaw is possibly an oxidation product. This is more likely to be the case if the soluble oil contains any appreciable quantity of free fatty acids. Or the deposit may be a resinous substance, if the soluble oil contains free rosin acids, which is not impossible since many soluble oil bases contain a soap of a fatty oil or fatty acid, "free rosin" or "rosin oil," and a solvent.

The deposit is not likely to be soap, in view of the fact that soluble oil bases contain "water-soluble" soaps. Under certain conditions, the gummy substance might be oxidized mineral oil, but this is less probable. It is more likely that the deposit is one of the two first-mentioned substances.

The difficulty should be explained to the manufacturer of the soluble-oil base, who, if he finds complaints increasing in number, will undoubtedly change the composition of his product. The only precaution that can be taken by the user is to make sure that the soluble oil is properly mixed with the water in such proportions that a stable emulsion results. Also, any lack of stability in the cutting emulsion, when in use, should be corrected at once. At the first signs of separation, as indicated by an oily layer on the surface of the cutting emulsion, either water or soluble oil should be added until a stable emulsion is obtained.

Soluble oils containing alcohol are likely to show an oily separation in a relatively short time, due to the evaporation of the alcohol. In such cases, the addition of a small amount of alcohol or a mixture of alcohol and water will stabilize the emulsion.

ACCEPTING PART OF A SHIPMENT

L. L. D.—About six months ago, I ordered three machines, which were promptly shipped and delivered. I assembled all the machines but installed only one of them. This one was found not to comply with the manufacturer's guarantee. However, I needed the machine, and paid for it, at the same time requesting the manufacturer to take back the

other two machines, as they were not what he had guaranteed them to be. The manufacturer refused to take back these two machines and stated that since I accepted one of the lot of three I would be compelled to pay for the other two. If a buyer accepts one of a lot of machines which are not equal to the quality guaranteed by the maker, is he compelled to accept and pay for the others?

Answered by Leo T. Parker, Attorney at Law, Cincinnati, Ohio

No, you are not compelled to accept the other two machines, provided they do not meet with the conditions of the guarantee made by the manufacturer at the time the contract of sale was completed. In a leading case (66 N. H. 621), a purchaser ordered five lots of merchandise. After receiving and examining the complete shipment, he accepted three of the lots and sent his check in payment therefor, but refused to pay for the other two lots on the grounds that the entire lot of the merchandise failed to conform to the specifications in the contract regarding quality. The seller sued the purchaser for the full value of the shipped merchandise, on the grounds that since the buyer had accepted three lots of the merchandise, he was bound to accept and pay for the other two. However, the Court held the buyer not liable, and explained that a purchaser may refuse to accept any or all of a shipment of merchandise which does not meet with the terms of a guarantee. This Court also clearly held that acceptance by the purchaser of a portion of the order does not in any sense obligate him to pay for the balance of the lot, provided he promptly notifies the seller that the merchandise is unsatisfactory and that he intends to return a portion of the shipment. (See also, 91 N. Y. S. 722).

DIP OR IMMERSION BRAZING

V.A.T.A.—Is there a progressive way of brazing small steel castings by first preheating them in one furnace and then dipping the portion to be brazed into molten spelter in another furnace in such a way as to fill up small defects or cracks with the spelter? If possible, give the temperature of the preheating furnace and the melting pot.

Answered by A. Eyles, Moston, Manchester, England

The rapidity with which cracks and small defects in steel castings can be satisfactorily brazed by the dip or immersion method cannot be equaled by any other system of brazing. It is essential, however, that all scale, rust, and dirt be removed from the immediate vicinity of the defective surfaces to be brazed. The cleaning may be done by filing, scraping, scratch-brushing, grinding, or, better still, by sand-blasting, which not only takes off scale, oxide, and dirt, but leaves the treated areas full of minute cavities to which the brazing spelter readily adheres. Sand-blasting is also a good method for cleaning the surfaces after brazing.

The work should be preheated before dipping in the molten spelter. This can be done in a preheating furnace or in flux baths until the castings attain a temperature of about 1292 degrees F. To prevent the brazing spelter from adhering to other parts of the casting, a mixture of graphite and molasses should be painted on. After this blackening mixture has become dry, powdered borax may be dusted on the bright surfaces to be treated. Great care should be taken to keep the blackening mixture out of the cracks and also away from the clean surfaces, as otherwise the spelter will not flow where it is required.

In making brazing spelters, it is important that the constituent metals be commercially pure, since impurities interfere with the ductility and strength of the brazed metal. The spelter generally used in brazing is a copper-zinc alloy containing equal parts of the two metals, but the following spelters are recommended by the writer for brazing defective steel castings, as they are more ductile and possess greater tensile strength.

Composition and Melting Temperatures of Dip Brazing Alloys

Copper, Per Cent	Zinc, Per Cent	Melting Temperature, Degrees C.	Melting Temperature, Degrees F.
64.4	33.6	918	1684
63.0	37.0	908	1666
60.0	40.0	890	1634

It is very important that the molten spelter be of the proper temperature. A pyrometer is, therefore, necessary in order to regulate the temperature of the brazing bath to the proper point, which ranges between 1724 and 1742 degrees F. At 1742 degrees F. the zinc in the brazing spelter volatilizes in the form of a greenish vapor, and this provides a check on the pyrometer reading.

Another important factor is the thickness of the flux. This should cover the molten spelter to a depth of about 1 inch with the flux entirely molten. The flux generally used is granulated borax, and its function is presumably that of dissolving the oxides in the fused material. A flux consisting of two-thirds borax and one-third boric acid will, however, give the most satisfactory results. Borax flux, when used alone, is very difficult to remove from the vicinity of the cracks and other brazed areas after cooling; hence, the slight extra cost is compensated for by using the boric acid and borax mixture.

The castings should be dipped into the molten spelter by the use of suitable tongs and should be completely submerged in the spelter. When the temperature of the castings and the temperature of the spelter are approximately the same, the castings should be taken out of the molten spelter and shaken so as to remove any surplus spelter.

Difficulty will, perhaps, be experienced at first in obtaining good results. If the instructions are carefully observed, however, a little practice will bring success. An experienced operator usually judges the temperature of the bath by the freedom with which the spelter flows into the cracks and over the cleaned areas, as well as by the color of the spelter upon cooling.

TURNING SPHERICAL SEATS FOR HELIUM CONTAINERS

Some interesting constructional features are incorporated in the helium tank car shown in Fig. 1, which was recently built for the United States Navy by the General American Tank Car Corporation. The car has a capacity for holding approximately 200,000 cubic feet of helium, which is contained in twenty-eight seamless tubes, each having an outside diameter of 18 1/2 inches and a length of about 37 feet. Each of these cylinders weighs approximately 5400 pounds and is held at the ends by a spherical flange, clamped in anchorage grooves.

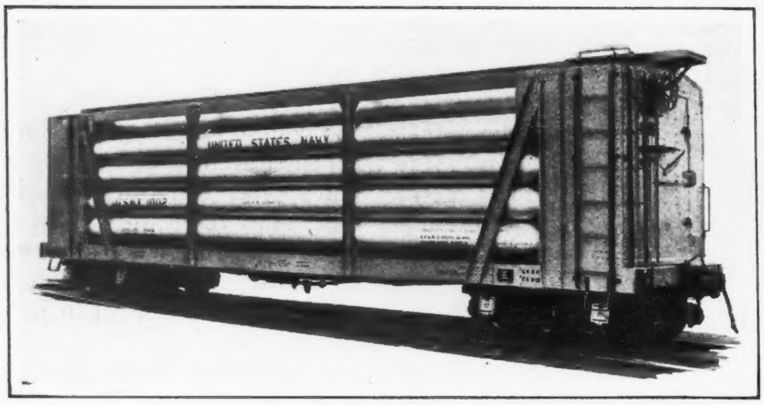


Fig. 1. Helium Tank Car with a Capacity for Holding 200,000 Cubic Feet of Gas in Twenty-eight Seamless Tubes

In Fig. 2 is shown a Bullard vertical turret lathe equipped for machining parts for the anchorage assemblies of the helium tubes. The part shown in the chuck is required to have a spherical seat turned at *A*. The tool for performing this operation consists essentially of a holder *B* clamped to the turret, a worm-wheel *C* and worm *D*, a tool-holder *E* mounted on worm-wheel *C*, and a handwheel *F* secured to the worm-shaft. When the turret is located in the proper position, the machine is started and the handwheel *F* used to revolve the tool *G* about the bearing stud of the worm-wheel *C*. The point of the tool, which is set the correct distance from the center of the worm-wheel stud, turns the spherical seat to the required radius.

It may be of interest to note that the helium containers were made from open-hearth seamless steel tubes produced by the Pilger process. The chemical composition of the steel is as follows: Carbon, 0.35 to 0.48 per cent; manganese, 1.25 to 1.50 per cent; silicon (maximum), 0.25 per cent; sulphur (maximum), 0.04 per cent; phosphorus (maximum), 0.04 per cent. The ultimate tensile strength of this steel is 90,000 pounds per square inch, and the elongation, 20 per cent in 2 inches. The cylinders are tested to a pressure of 3360 pounds per square inch, and have an operating pressure of approximately 2000 pounds per square inch.

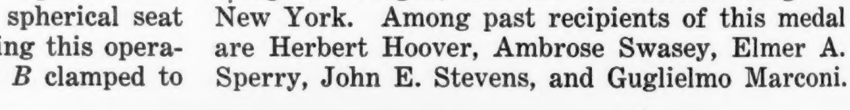


Fig. 2. Turning Spherical Seats on Anchorages for Helium Containers

* * *

RALPH MODJESKI RECEIVES THE JOHN FRITZ MEDAL

The John Fritz Medal Board, composed of sixteen recent past-presidents of the four national engineering societies—civil, mining and metallurgical, mechanical, and electrical—which have a combined membership of 60,000, has awarded the John Fritz Medal for 1929 to Ralph Modjeski "for notable achievement as an engineer of great bridges combining the principles of strength and beauty." The John Fritz Medal is the highest honor that can be conferred upon an engineer by the American engineering societies.

Mr. Modjeski was born in Cracow, Poland, in 1861, and came to this country with his parents in 1876. He obtained his engineering education at the Ecole des Ponts et Chaussees in Paris, where he graduated at the head of his class. As a designer, construction engineer, and consultant he has been identified with the construction of many of the most notable bridges in America, among them the McKinley bridge over the Mississippi at St. Louis, the Columbia River bridge in Oregon, and the Manhattan bridge in New York. Among past recipients of this medal are Herbert Hoover, Ambrose Swasey, Elmer A. Sperry, John E. Stevens, and Guglielmo Marconi.

Development and Application of Hard-Facing

Methods and Materials Employed in a Newly Developed Process of Applying a Veneer of Hard Alloy to a Metal Surface by Fusion Welding

By MILES C. SMITH

HARD-FACING is defined as the process by which a thin veneer or overlay of hard abrasive-resistant alloy is applied to any metallic surface by welding with the oxy-acetylene torch or the electric welding arc. Many types and kinds of alloys are used for this process, and almost as many methods of application are employed. The results are identical, however, and in all cases the process consists of welding.

Hard-facing was developed in connection with the petroleum exploration work in California where petroleum deposits were located at depths of more than 7000 feet below the surface. The severe service to which the drilling tools were subjected in this work led to a search for some practical means for increasing the durability of the cutting edges. Hard-facing proved to be an efficient method of doing this. After having been found to be thoroughly practical and efficient in oil-well work, hard-facing was successfully applied to other fields, where its advantages were quickly recognized.

Repairing Oil-well Tools by Welding on Metal Led to Development of Hard-Facing

In 1921, oil-well tools which had been worn excessively in service were rebuilt to their former dimensions by welding on metal instead of reforging them to size. With but a few exceptions, the metallic content of the metal welded on was about the same as the tool itself and, in service, these built-up sections stood up no better than the original tool.

At this time stellite had been on the market for many years, and was in common use for all types of machining operations. This metal contains no iron, and is really an alloy of cobalt, chromium, and tungsten. Its pronounced hardness and abrasive-resistant qualities were of great benefit in its application to machine tool work. Although it was not furnished in welding electrode form at that time, stellite possessed many of the characteristics desired in the hard-facing of oil-well drills, and it was applied to this service.

In 1922, Stoody Bros., who maintained a welding shop at Whittier, Cal., which specialized in welding oil field equipment, began a series of experiments and eventually developed alloys that could be supplied in the form of electric welding electrodes and that would leave a deposit, after being welded on, that was highly resistant to abrasive action.

The first of these developments was an alloy welding rod in which metallic alloys, mixed in the required proportions in their free, unfused state, were held in a soft steel jacket. This welding rod was designated and marketed under the name of Stoody's self-hardening welding rod. Later, a smelted alloy welding rod was perfected and marketed under the trade name of "Stoodite." Both of these welding rods were, and still are, prepared according to a private formula, and their constituents have never been made public.

The success of these developments resulted in the recognition of hard-facing as a possible solution for the tool problems of the oil mining industry. Today, oil-well tools are designed to be hard-faced, and the abrasive-resistant alloy is deposited before the tools are placed in service.

Three Classes of Alloys Used in Hard-Facing

Quite a number of alloys have been developed for specific purposes, but are applicable to a wide range of hard-facing work. In general, these alloys are of three classes: The first consists of welding rods that may be fused to the surface of the tools, leaving a deposit which is abrasive-resistant to a certain degree, and which, when used as an over-

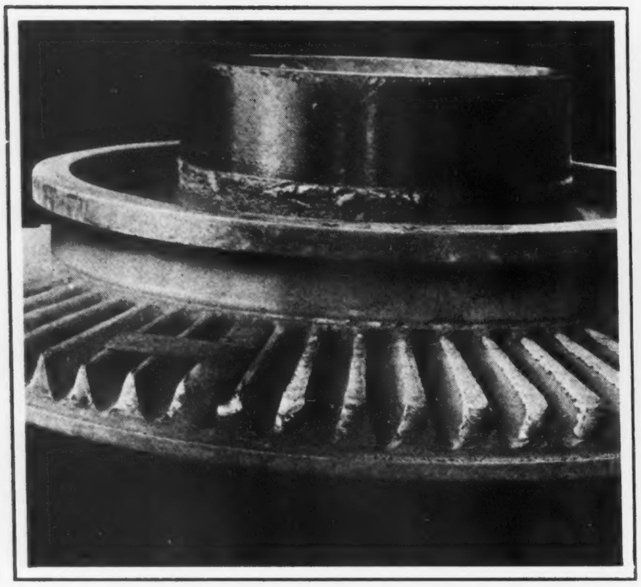


Fig. 1. Using a Copper Form in Building up Worn Gear Teeth so They can be Ground to Their Normal Size

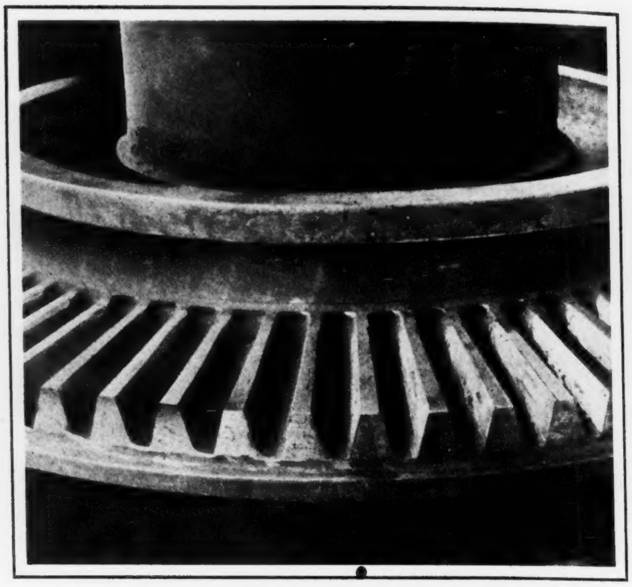


Fig. 2. Gear Shown in Fig. 1 after Having Been Completely Rebuilt by Welding on Metal and Grinding to Size

lay, will provide a tough as well as an abrasive-resistant surface.

The second class includes alloys that may also be fused to the tool metal, but that leave a deposit which is still harder than that of the first class, but which has a tendency to develop brittleness if the cutting edges are unsupported or are not properly backed up. The third class comprises what are known as "diamond substitutes." These fused alloys are too hard and have too high a melting point to be fused to the tools and are applied by either brazing or welding around them sufficiently to hold them in place. The latter class of alloys is used for core-drilling tools and for tools employed in cutting through unusually hard materials.

The "Self-hardening Rod," "Stoodite," and "Borium" alloys made by the Stoody Co. are examples of alloys covering the first, second, and third classes. Hascrome, Haynes stellite, and Haystellite, manufactured by the Haynes Stellite Co., will also fulfill the requirements of all three applications. The Mills Process Alloys Co. specializes more particularly in the third class of alloys, which it markets under several trade names. The Blackor Co. and more than a half dozen others market more than one class of alloys.

Encouraged by the success attained in oil-well service, the sponsors for the welding on of such alloys extended their experiments to other fields. At first they confined their efforts to equipment subjected to wear similar to that encountered by oil field tools, but little by little the field of operations was enlarged so that there is now available a fund of information and experimental data. With the knowledge thus gained, it is actually possible to apply hard-facing to any assembly and be reasonably sure of obtaining satisfactory results.

The Problem of Finding a Suitable Hard-facing Alloy

Prior to the successful development of hard-facing, manganese was almost universally accepted as being the one alloy that could be mixed with or used to overlay steel or iron to secure a hard abrasive-resistant surface. Naturally manganese was the first material thought of in developing the new welding process, but, even with a protective slag coating, the manganese had a tendency to oxidize during the welding operation, so that the deposit was found to have very little of the characteristic hardness of manganese.

An alloy of chrome-nickel steel was tried out as a hard-facing material with some success. Other alloys were then tried out, one after another, until the merits of tungsten-carbide were discovered. Fused tungsten-carbide leaves a deposit that has almost diamond hardness, and

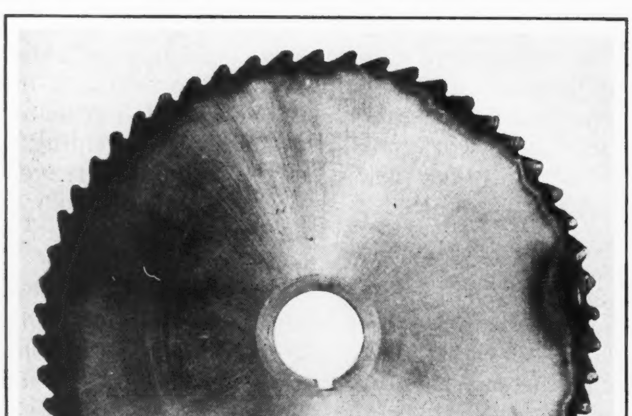


Fig. 3. Saw for Cutting Marble, which has Hard-faced Cutting Surfaces

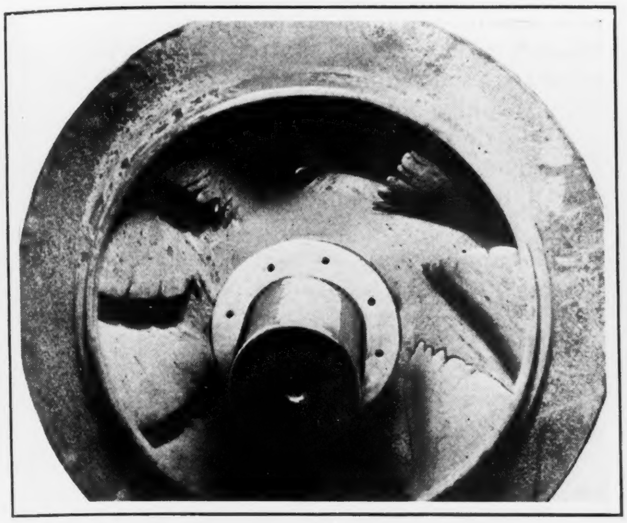


Fig. 4. Pump Propeller Wheel with Worn Vanes

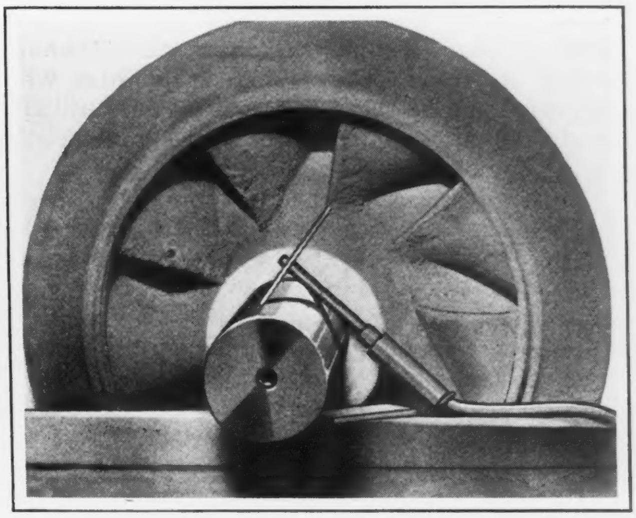


Fig. 5. Wheel Shown in Fig. 4 Repaired by Welding

that, although having a tendency to crumble, may be very successfully used as a hard-facing material. At present, many alloys are being recommended for the hard-facing process. Although varying to some extent in their chemical formulas, nearly all of them depend on tungsten-carbide for their hardness.

Naturally the compounding of metallic alloys is a metallurgical problem. In the case of hard-facing alloys, the problem does not end with the compounding of the welding alloys, for in welding, the alloy is again fused with the metal to which it is applied, so that the metallurgical problem follows through until the alloy has been applied and allowed to cool. Either the electric arc or the oxy-acetylene flame is capable of temperatures far higher than the melting points of most metals and their use in applying the metals employed develops further complications.

Theory of the Mixed Alloy Welding Rod

One of the first accepted hard-facing alloys to be supplied in welding electrode form was the "Self-hardening Rod" placed on the market by the Stoody Co., an outgrowth of the Stoody Bros. welding shop. This material was unique in that it consisted of a soft steel outer shell within which the unfused mixture of compounded alloys was held. It was the theory that the alloys of this rod would be thoroughly fused when melted down.

Thus by supplying the alloys in their native form, yet mixed in the proper proportions, there seemed to be every likelihood of securing a welded on deposit that would be of uniform hardness, especially if applied by means of the electric arc. When applied with the oxy-acetylene torch, there was the possibility of changing the chemical

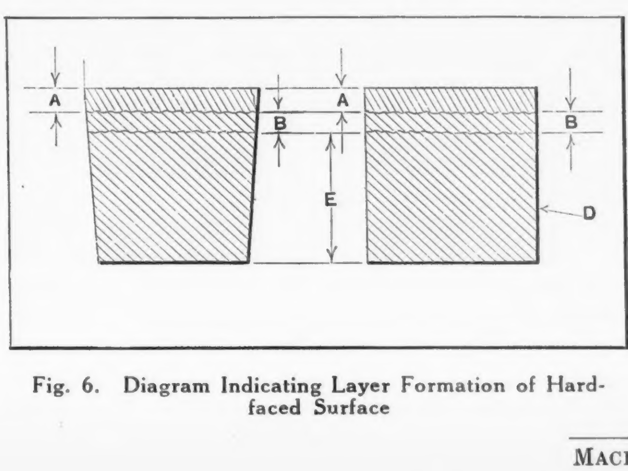


Fig. 6. Diagram Indicating Layer Formation of Hard-faced Surface

ratios through reduction or oxidation by undue heating of the alloy deposit after its application.

Aside from the "Stoody Self-hardening Rod," the hard-facing alloys are, almost without exception, furnished in a smelted mixture, either in the form of a welding rod or an arc-welding electrode, or in the form of small broken bits of smelted alloys which may be attached to a metallic surface by welding in with other alloy welding material. The latter form applies only to a number of products that have recently been placed on the market as substitutes for industrial diamonds.

Fig. 6 is a more or less distorted diagram taken from an actual photomicrograph of a cross-section to which hard-facing was applied. This section combines three zones. Zone *A* represents the hard-facing alloy, zone *E* the parent metal to which the alloy has been applied, and zone *B* the area in which the actual amalgamation of the hard-facing alloy and the parent metal has taken place. Practically every application of hard-facing examined up to the present time is divided into three zones as described. The three zones, *A*, *B*, and *E* will be referred to from now on to facilitate describing the metallic conditions existing in the different layers of metal.

Substituting Hard-Facing for Heat-treatment

Hard-facing is intended for use wherever it is desired to obtain a hard abrasive-resistant surface. The manufacturers of hard-facing alloys maintain that nearly any metal that can be welded can be hard-faced. However, the process is seldom, if ever, applied to any metal other than steel or cast iron. In most instances, hard-facing is used as a substitute for heat-treatment, particularly where surface hardness is re-

quired. The contention of those favoring hard-facing is that this process offers an economical method of securing hard surface qualities when necessary, and at the same time permits utilizing a material having entirely different characteristics for the body of the machine or part.

Referring to Fig. 6, let us assume that the zone *E* is a machine part which is subject to abrasion and which, by the usual procedure, would either be heat-treated or carburized to obtain the desired hardness. Instead of heat-treating this part, let us apply hard-facing and note the result. The first problem in applying hard-facing is to secure an alloy welding rod or material that will leave a deposit of the desired degree of hardness and abrasive-resistant quality.

After securing the proper alloy, the next step is to select the method of applying the metal. Nearly all, if not all, hard-facing metals on the market today have an individual method of application which gives the best results. Space does not permit treating these alloys individually or in detail, but the principal methods will be referred to briefly in order to give a conception of the results that may be obtained.

Kinds of Hard-facing Alloys Available

The hard-facing alloys made by the Stoody Co. and certain other manufacturers are furnished in the form of arc-welding electrodes, and their application by the electric arc is recommended. This does not mean that they cannot be applied by the oxy-acetylene welding torch, but the manufacturers believe that the electric arc will give the best results. On the other hand, the manufacturers of stellite recommend the use of the oxy-acetylene flame in applying this alloy for hard-facing. Incidentally, stellite was one of the first alloys to be used in the so-called "half soling" of metal cutting tools used in machine shops, and has been furnished in welding rod form since 1923.

Still another manufacturer, the Blackor Co., furnishes its alloy in the form of a powder, and instead of utilizing a metallic arc-welded process suggests that the alloy powder be puddled or fused to the parent metal with a carbon pencil welding arc. Another layer of alloy is then fused with the first and so on until the final or uppermost layer of the desired quality has been applied. By this method there are several separate strata which vary in hardness from the parent metal to the exterior layer which, in this instance, should be almost pure tungsten-carbide.

Every one of the separate processes is designed to secure the same result and, as far as acquiring a hard abrasive-resistant surface is concerned, any of them will, under ordinary conditions, obtain the desired object. However, particularly in machine design fabrication, there are other considerations besides the hard abrasive-resistant surface, and it is to attain perfection that further experiment and development is taking place. For example, it may be necessary to carry the hard surface out to a sharp or abrupt corner. In such instances, it is desirable that the hard-surfacing material show no tendency to crack or shatter. Experiment has shown that the required quality or degree of hardness is usually obtained at the sacrifice of toughness, and there is no exception to this in the case of hard-surfacing alloys. Crumbling may be checked to some extent by backing up the hard surface as well as possible. It is quite essential in some applications to sacrifice hardness to its extreme limit and secure an alloy that will have sufficient cohesion within itself to resist crumbling.

Advantages Offered by Hard-facing Process

A review of the successful application of hard-surfacing shows that with the proper amount of care, and with suitable provision in the design to meet the conditions, hard-facing may be employed with resulting economy in fabrication and a surprising reduction in replacement and maintenance costs. When machine parts are subjected to considerable friction or to excessive abrasive wear, they may be hard-surfaced before they are put into service, with satisfactory results.

Heat-treatment is not only expensive but necessitates using a metal which chemical analysis shows to be best adapted for the treatment employed. Hard-facing demands nothing of the parent metal other than that it be of such an analysis that it can be welded. Furthermore, a surface that has been prepared by hard-facing can, when the veneer of hard surfacing wears off, be resurfaced readily. The prepared surface will then be as well protected as when new. Hard-surfacing is particularly well adapted for maintenance work, because in its application, there is no necessity for subjecting the equipment or part treated to heats or conditions that will alter its metallic structure or cause distortion.

Of late, many so-called "diamond substitutes" have been placed on the market which are claimed to be adaptable to hard-surfacing as well as to applications formerly employing industrial diamonds. These diamond substitutes, aside from their method of application and the fact that their hardness prohibits ready grinding to smoothness after they have been applied, may be classified with the other hard-surfacing alloys for all processes with which the machine designer is concerned. They have been found especially well suited to the requirements of oil field tool work, because no particular surfacing other than that secured in their application is necessary. For other types of equipment their selection would be economical only where the cost of finishing them to the required smoothness would be permissible or where no finishing at all was required.

* * *

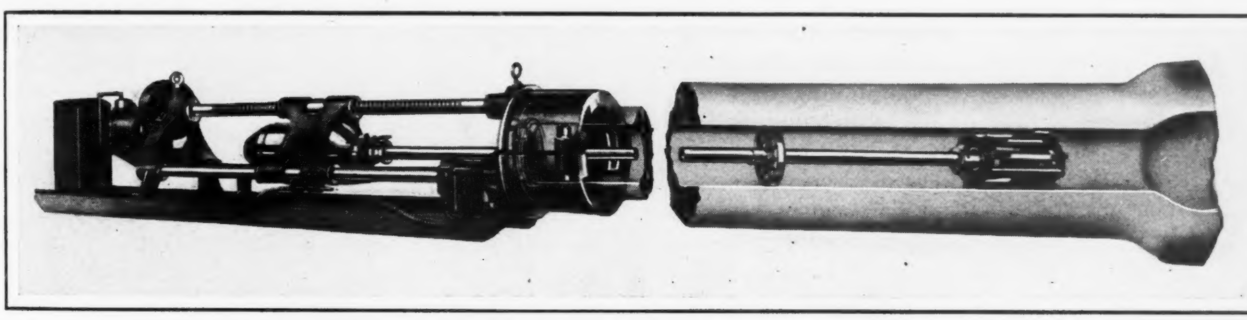
According to the National Automobile Chamber of Commerce, the September production of motor vehicles in the United States was about 417,000. The production for the first nine months of 1929 was equal to 4,828,700, exceeding the total production for 1928, which was 4,601,130.

GRINDER FOR RECONDITIONING BORES OF NAVAL GUNS

By R. H. RAUBE, General Electric Co., Detroit, Mich.

The gun grinder shown in the accompanying illustration is the first machine of its type to be used for reconditioning the bores of large naval guns. It was built recently by the Hutto Engineering Works, Inc., Detroit, Mich., and is to be used in reconditioning 12-, 14-, and 16-inch guns. The reconditioning operation consists of removing copper obstructions along the rifling of the gun. As a rule, the 12- and 16-inch guns are 42 and 48 feet in length, respectively. Support for the spindle used in grinding the full length of the rifling of these guns is provided by seven centralizing rests like the one shown in the illustration. These rests, which have the appearance of flat-tired wheels, are equally spaced along the shaft.

Heretofore, the reconditioning of a single gun has taken from ten to fourteen days and required the labor of many men who were under the supervision of experts. With the grinder shown in the illustration, a few men can recondition a gun in one or two days. Preliminary tests indicate that the accuracy obtained with this grinder is within limits of 0.001 inch for the complete range of travel.



Grinder for Removing Copper from Rifling of Large Guns

The grinding head of the machine is driven by a 7 1/2-horsepower direct-current motor having a speed of 1800 revolutions per minute. This motor is built into the gear-box and is directly connected to it. The gear-box is traversed by means of a worm-gear driven by a reversible three-horsepower direct-current motor having a speed of 1800 revolutions per minute. Both motors are controlled from one panel. The drum reversing switch for the three-horsepower reversible motor and the master switch that controls the 7 1/2-horsepower grinder-motor are interlocked so that the grinder spindle must always be in operation before the longitudinal traverse is started. This safety feature is provided to eliminate danger of scoring the gun barrel.

At each end of the guide rods is a limit switch which stops both motors when the gear-box head reaches the extreme end of its travel. The purpose of this safety feature is to prevent the gear-box head from being jammed against the end supports through negligence or carelessness on the part of the operator.

NEW METHOD OF TEACHING PATTERN DESIGN

By B. RUPERT HALL

The interest now being shown by manufacturers in the training of engineering students is a real incentive for those engaged in teaching subjects that apply to manufacturing processes.

At the University of Illinois the question of how patternmaking and pattern design ought to be taught to engineering students has been given a great deal of thought. Having carefully considered the value of the training in the actual making of a pattern, compared with the amount of time consumed, it seemed expedient to concentrate on design rather than on manual work in the patternmaking course. Thus the student is taught the principles of pattern design and learns to express his ideas through sketching and drawing.

The subject of patternmaking is taught with the view of giving to the student only such training as may be of practical use to him as a designer. The procedure is as follows: Various types of patterns, core-boxes, and auxiliaries are used as demonstration material. This familiarizes the student with different practical ways of producing the piece with the least effort. By a careful study of these processes, he is enabled to design a cast part in such a way as to facilitate the work of all concerned.

To acquaint him with pattern construction, the student is given problems including many different methods used in joinery. He sketches the form of a piece or pieces required to construct the pattern. The next step is the study of the master pattern necessary to produce a metal work-pattern, attention also being given to triple shrink patterns and their purpose. The design of metal pattern equipment is studied extensively, including pattern plates, patterns, core-boxes, core dryers, core wire-binding devices, core-setting devices, etc. Problems are presented requiring the designing of special devices for making a mold or core which will reduce the work to a minimum.

Pattern department management is also taught, in order that the student may be capable of organizing such a department in a systematic manner, to care for the large amount of detail usually involved. Under this method of instruction, the students obtain a greater amount of technical knowledge, and know more about patterns than when they actually made patterns in the university shops.

National Machine Tool Builders' Meeting

Advantages of Apprentice Training, Analysis of Distribution Costs, and Industrial Statistics Were the Important Subjects Presented

THE National Machine Tool Builders' Association held its twenty-eighth annual convention at Briarcliff Lodge, Briarcliff, N. Y., October 21 to 23. The convention activities were divided into group meetings and general sessions. The twenty group meetings were conducted by various divisions of the industry, in order to give manufacturers of the different general classes of machine tools an opportunity to discuss matters of interest to each particular group. The four general sessions were devoted to subjects of interest to all members of the association.

An important feature of the first general session was the address of the president, Henry Buker, vice-president of the Brown & Sharpe Mfg. Co., Providence, R. I. Mr. Buker dealt briefly with several subjects of particular interest to machine tool manufacturers, the first being apprentice training. No attempt was made to outline the kind of course that should be established, but rather to point out the important reasons for establishing apprentice training systems. "Apprenticeship courses," said Mr. Buker, "will give young men with mechanical inclinations the opportunity of training in the right direction, and will provide good material for the future growth of mechanical industries in the district. Each of you can properly decide for yourself the character of the training you think will best fit your men to be good mechanics or good executives. I would suggest, however, that a rigid schedule be laid down, and that this be followed carefully. The very rigidness of such a course is much in its favor, for it takes a young man at the age when he is susceptible to influence and trains him along definite lines.

"You need as your assistant foremen and foremen, men who have received a thorough training and whose habits and experiences have been such as to make them understand the thoughts and habits of the men under them. An apprenticeship course, properly handled, is the very best school from which to draw future factory executives. Any concern, no matter how small, that does not have such a course is, in my judgment, neglecting a real opportunity. While I have in mind the thought of appealing to the shops that do not have an apprenticeship system, there is much to be said to concerns that have such a system already installed but do not make the fullest possible use of the apprentices they have under training.

"The general manager of a business should either interview each apprentice at least two or three times during his training, or else he should delegate a committee of three, composed possibly of the factory manager, the sales manager, and the chief engineer, to talk with the boys occasionally and find out, as far as possible, their leanings and aspirations.

"There have been many apprentice boys who have been failures in the shop, but who have proved to be exceptional designers or salesmen. The shop foreman is often inclined to judge a boy solely by his ability to produce work accurately and cheaply. Some of our most brilliant men are naturally clumsy with their hands, and we have all known good executives who could tell others what should be done and how to do it, but could not do the work themselves if called upon to do so. Frequently, the boy with initiative and a brilliant, inquiring mind causes more or less annoyance to his foreman, whereas the quiet type, who asks no questions and does his work methodically and well, wins high praise, although he has no executive ability.

"Many concerns have remarkable executive material among their apprentices which they never discover, because the management does not actually seek for signs of such ability, but rather leaves it to the men down the line to bring to their attention boys having such ability. How can you expect an assistant foreman, who has always thought in terms of his own work, to point out to you a potential Ralph Flanders, a Clayton Burt, or an Ambrose Swasey?"

The second topic in the president's address related to further improvement in trade practices in the industry, especially in regard to maintaining the highest possible business standards. The value of the association to individual members was the third topic discussed. It was pointed out that, aside from papers and discussions at the meetings, great benefit may be derived from personal contacts. The final point related to the importance of developing among the younger members of the industry an interest in the regional and national meetings. "They should be encouraged to attend and gradually take their part in our activities. Whenever possible bring to these meetings one or two of the younger men who are assuming places of increasing inportance in your organization. This will be a direct benefit to your own business, and it will pay you well from that angle. But at the same time you may feel that in bringing these men to meetings, you are taking the same interest in the future of this industry as you have shown in developing young men in your own business."

At a following session, the subject "Business Needs to Analyze Distribution Costs" was presented by W. B. Castenholz of the LaSalle Extension University. During the fourth and final session, the subject "Industrial Statistics as Tools of Business Management" was presented by Dr. Virgil Jordan, economist for the *Business Week*.

PRESSURES, IN POUNDS, REQUIRED FOR FEEDING DRILLS

Drill Diameter, Inches	Feed per Revolution, Inches: 0.004	0.006	0.008	0.010	0.012	0.014	0.016
	Approximate Feeding Pressures for Cast Iron						
1/16	75	125	150	200	235	275	325
1/8	100	150	200	250	300	350	400
1/4	135	200	275	325	400	460	525
3/8	175	250	325	410	500	575	650
1/2	200	300	400	500	590	685	780
5/8	250	350	475	580	700	810	925
3/4	275	400	540	675	800	925	1050
7/8	300	450	600	750	900	1035	1190
1	350	500	675	825	1000	1150	1325
Diameter	Pressures for 30 Per Cent Semi-steel						
1/16	75	110	150	...	...	...	...
1/8	100	150	210	265	310	...	...
1/4	160	235	315	390	465	535	610
3/8	210	310	410	505	605	700	800
1/2	265	375	500	625	740	860	975
5/8	315	450	600	725	875	1025	1160
3/4	350	525	675	850	1000	1175	1330
7/8	375	575	750	925	1125	1300	1475
1	430	630	830	1030	1230	1430	1630
Diameter	Pressures for S. A. E. 0.20 Per Cent Carbon Steel (1020)—28 Scleroscope						
1/16	60	90	110	125	...	...	...
1/8	110	150	190	225	260	...	...
1/4	200	275	350	415	480	550	625
3/8	300	400	500	600	700	800	900
1/2	390	525	650	775	915	1050	1175
5/8	475	650	800	975	1135	1300	1460
3/4	575	775	960	1150	1350	1550	1750
7/8	675	900	1125	1350	1575	1800	...
1	760	1025	1275	1550	1800	...	...
Diameter	Pressures for S.A.E. Nickel-chromium Steel (3140)—45 Scleroscope						
1/16	100	125	160	190	...	...	...
1/8	150	200	250	290	325	...	...
1/4	300	375	450	575	600	690	760
3/8	425	550	660	775	890	1000	1125
1/2	550	700	860	1000	1160	1325	1450
5/8	675	875	1050	1250	1425	1625	1800
3/4	800	1025	1250	1475	1700	...	...
7/8	925	1175	1450	1700	...	...	...
1	1050	1325	1600	...	...	...	...

Factor of safety of 1.5 should be allowed for increase in pressure when drills become dull; the pressures given are for sharp drills having normal points.

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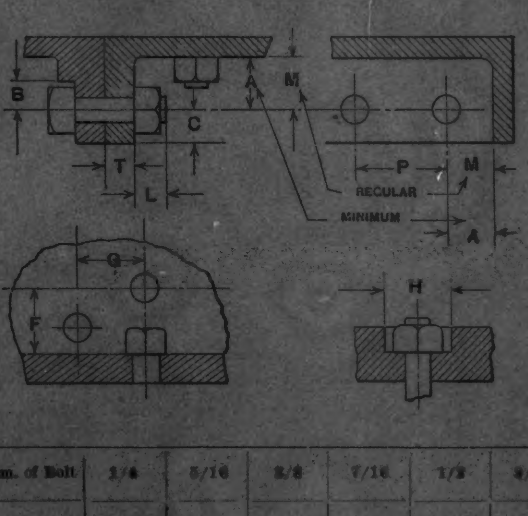
MACHINERY'S Data Sheet No. 165, New Series, November, 1929

TABLE OF CLEARANCES FOR NUTS AND BOLT HEADS



This table is for use as a guide in selecting bolt sizes and locating bolt-holes so that difficulty in removing nuts will be avoided.

A = minimum distance that will permit the nut to be turned;
B = distance to stop-shoulder required to prevent either square- or hexagonal-head bolts from turning;
C = minimum distance for uniform strength;
L = dimension to be added to total thickness of flanges *T* to give bolt length;
T = thickness of flanges for corresponding bolt diameters;
P = pitch or center-to-center distance between bolts (Minimum *P* = smallest pitch that will permit use of standard wrench. Maximum *P* = pitch at which flanges begin to show tendency to spring open between bolt spaces, and should never be used where parts are subjected to more than a few pounds' pressure.);
F = minimum dimension when two bolts are in line, and must not be decreased unless bolts are placed out of alignment a distance not less than that indicated by dimension *G*;
H = minimum diameter of counterbore that will permit use of box-type wrench;
M = minimum distance from center of bolt-hole to rib or wall that will permit a regular wrench to be used.

Diam. of Bolt	1/4	5/16	3/8	7/16	1/2	9/16	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2
A* Hex. Nut	5/16	3/8	7/16	1/2	9/16	5/8	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2
A* Sq. Nut	3/8	7/16	1/2	9/16	5/8	11/16	13/16	15/16	1 1/16	1 1/4	1 3/8	1 1/2	1 5/8	1 3/4
B	5/16	5/16	3/8	7/16	1/2	9/16	5/8	3/4	7/8	15/16	1	1 1/8	1 1/4	1 3/8
C	3/8	7/16	1/2	9/16	5/8	11/16	3/4	7/8	1 1/8	1 1/8	1 3/8	1 1/2	1 5/8	1 3/4
L	3/8	1/2	1/2	5/8	5/8	3/4	3/4	1	1 1/8	1 1/4	1 1/4	1 1/2	1 5/8	1 3/4
T Min.	1/4	5/16	3/8	7/16	1/2	9/16	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2
T Max.	5/16	3/8	7/16	9/16	5/8	3/4	15/16	1 1/16	1 1/8	1 1/4	1 1/2	1 5/8	1 3/4	1 7/8
P Min.	7/8	1 1/8	1 5/16	1 9/16	1 3/4	2	2 1/4	2 5/8	3	3 1/2	4	4 3/8	4 7/8	5 1/4
P Max.	1 1/2	1 7/8	2 1/4	2 5/8	3	3 3/8	3 3/4	4 1/2	5 1/4	6	6 3/4	7 1/2	8 1/4	9
F	3/4	15/16	1	1 3/16	1 1/4	1 7/16	1 1/2	1 7/8	2 3/16	2 1/2	2 5/8	3	3 1/4	3 1/2
G	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 5/8	1 7/8	2 1/8	2 3/8	2 5/8	2 7/8	3 1/8	3 3/8
H	7/8	15/16	1 1/16	1 3/16	1 5/16	1 1/2	1 5/8	1 7/8	2 1/8	2 3/8	2 5/8	2 7/8	3 1/4	3 1/2
M	5/8	11/16	15/16	1	1	1 1/8	1 1/4	1 3/8	1 5/8	1 7/8	2	2 1/4	2 3/8	2 3/4

* "A" is minimum; use dimension "M" as standard whenever possible.

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MACHINERY'S Data Sheet No. 166, New Series, November, 1929 Contributed by John S. Watts

Estimating the Power Requirements of a New Machine

It is sometimes necessary to determine the size of the motor, or the amount of power, required to drive a new machine previous to its construction. Of course, it is a comparatively simple matter to do this in the case of a machine that is to be an addition to a series already in existence, or when the machine is an improved design, of a type long in use. However, when the machine is of an entirely new design, the following information will serve as a guide in estimating the power required.

Starting at the cutting tool, assuming that we are considering a metal-working machine, we may trace back to the point at which the power is applied and list all the various mechanisms, bearings, etc., that consume power. The amount of power required by each of the elements listed can be determined quite accurately. A close estimate of the total power consumption can then be obtained by adding the values for the individual elements.

The power required for turning a number of common materials on a lathe, stated in the horsepower consumed per cubic inch of metal removed per minute, is given in the seventh revised edition of MACHINERY'S HANDBOOK, page 1400. The following tabulations give the horsepower required in removing 40 cubic inches of metal per minute.

Material	Horsepower
Hard steel	48
Mild steel	33
Cast iron	16
Brass	12

Reference to this table shows that 16 horsepower is required to remove 40 cubic inches of cast iron per minute. The total power required can now be obtained by adding 16 to the horsepower consumed through the transmission of power from the drive to the tool. In calculating the transmission power loss, we may assume that the efficiencies of various elements are as follows:

Element	Efficiency, in Percentage
Ball bearings	99
Roller bearings	98
Plain bearings	95
Spur gears with their bearings	96
Bevel gears with their bearings	95
Belting	96
Roller chains	95
Silent chains	97

The values given in this list are slightly lower than those given in most text-books. With good construction, some of the values may be somewhat higher but, in general, the tabulation will be found a satisfactory guide. By calculating the power consumed by the various drives, bearings, etc., and adding the result to the power consumed by the cutting tool, the total horsepower required can be estimated quite accurately. The estimate does not, of course, take into consideration such factors as marked irregularity in the material being cut, the high starting torque which may be involved, the reversal of movement and the drag of badly dulled tools. Allowances must naturally be made for all these factors. D. A. H.

Gear Manufacturers' Semi-Annual Meeting

The American Gear Manufacturers' Association held its semi-annual or fall meeting in Philadelphia, October 24 to 26. In addition to the presentation of several papers on subjects of general interest and value to the gear manufacturers, the various committees reported important progress in the development of different standardization and other projects. A general idea of the practical character of the work of this association is indicated by the committee reports, which included the following subjects: Commercial standardization; herringbone gears; keyways; tooth forms; gears and pinions for electric railway, mill, and mine use; inspection; non-metallic gearing; metallurgy; spur gears; worm-gears; bevel and spiral bevel gears; sprockets; and standard gear nomenclature. In addition, there is a library committee, a metric committee, a legal committee, a publicity committee, and also one on public policies.

Papers on the following important subjects were presented: "Gray Iron—a New Material," by E. J. Lowry, consulting metallurgist, Detroit, Mich. "Load and Speed Conditions of Worm-gear Drives," by Emil Dukes of Gears & Forgings, Inc., Cleveland, Ohio; "Tungsten-carbide Tools," by Dr. Samuel L. Hoyt, General Electric Co., Schenectady, N. Y.; "The Market for Gears," by W. E. Kennedy, sales manager, *American Machinist*, New York City; and "The Role of the Trade Association in Industrial Standardization," by Dr. P. G. Agnew, secretary of the American Standards Association, New York City. For several years it has been the practice at the fall meetings of the association to hold a session known as "Technical Standards Evening." In connection with this session, the members of the various committees meet with their respective chairmen and plan their work for the following months. The address by Dr. Agnew marked the opening of this session. At meetings of the industrial group and of the automotive group, conditions in the industries were discussed.

At a luncheon given to attending members and friends by the Philadelphia Gear Works, the Honorable Harry A. Mackey, Mayor of Philadelphia, spoke on "City Government and the Manufacturer."

Calorizing Steel to Prevent Oxidation

Method of Applying Calorizing Process to Mild Steel to Protect it Against Oxidation and Corrosion at High Temperatures

By B. J. SAYLES, President, Calorizing Co., Pittsburgh, Pa.

CALORIZING is a process whereby aluminum is driven into the surface of another metal, usually mild steel, to form an aluminum alloy. This alloy, when mild steel is the base metal, is immune to oxidation up to maximum metal temperatures of 1650 degrees F., and entirely resistant to the corrosive attack of gaseous sulphur products.

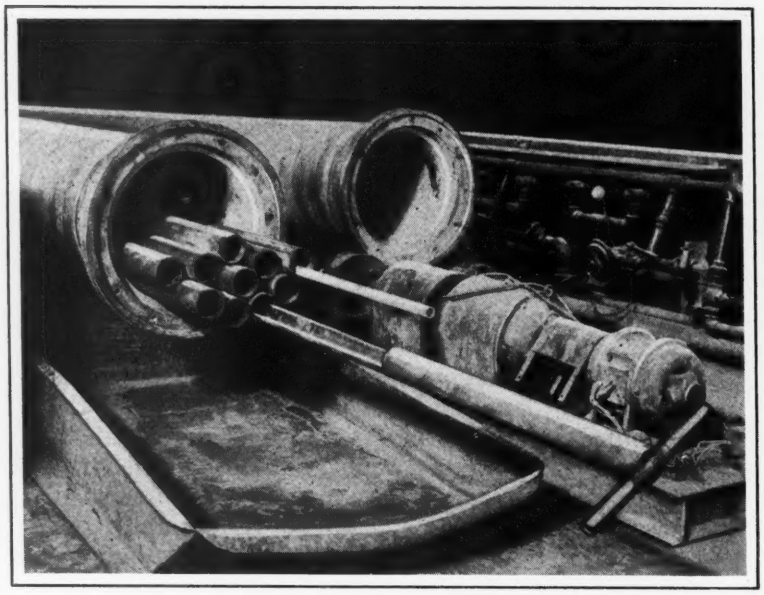


Fig. 1. Charging Calorizing Retorts with Seamless Steel Tubes

As a construction material, iron is ordinarily unsatisfactory at high temperatures because of oxidation and corrosion, but calorizing overcomes this defect to such an extent that it can be used successfully at comparatively high operating temperatures.

Calorized steel obviously has many uses. Among a variety of products that are being manufactured and fabricated from calorized steel may be mentioned pipe coils, such as are used for recuperators or air heaters in industrial furnaces. Calorized chrome iron and nickel-chromium alloy steels made by the Calorizing Co., Pittsburgh, Pa., also find wide application in the fabrication of carburizing boxes, furnace doors, door frames, and other equipment where rigidity and freedom from oxidation at high temperatures are essential qualities.

Application of Calorizing to Steel Tubes

One of the major applications of the calorizing process is to seamless steel tubing for oil still service. For this work, calorizing effects a marked

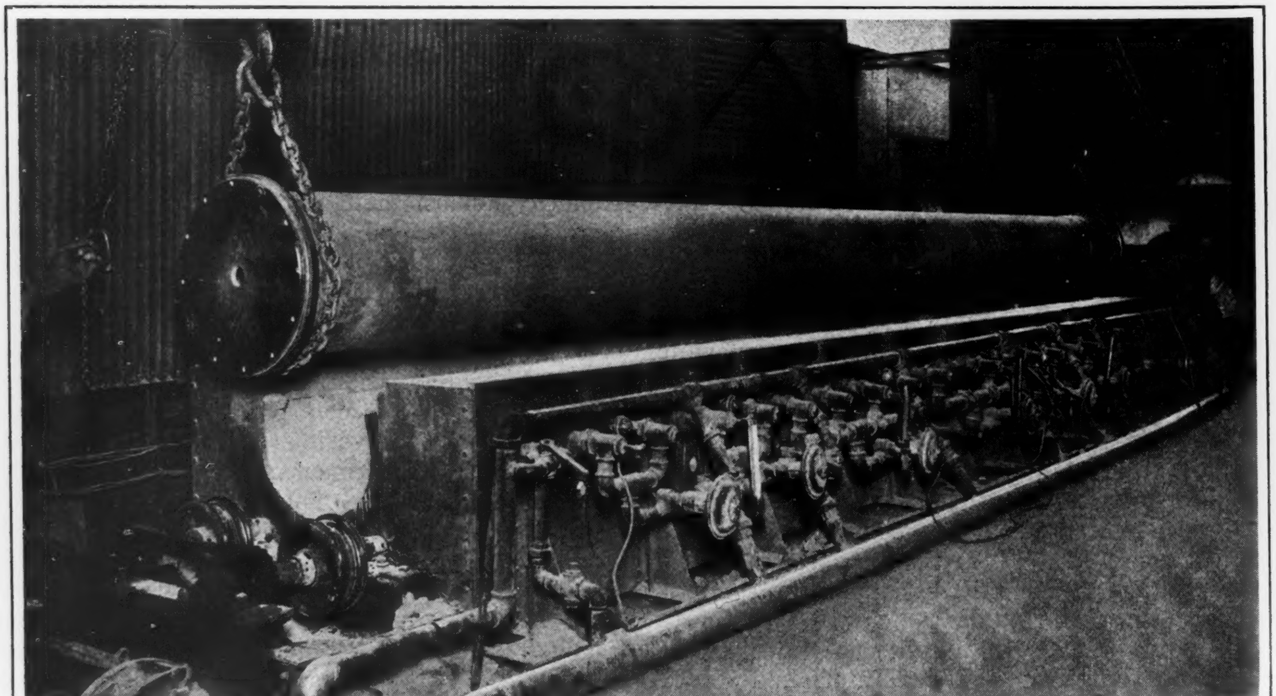


Fig. 2. Placing a Charged Retort in the Calorizing Furnace

reduction in tube maintenance cost. The calorizing of cracking still tubes serves two purposes, namely, that of rendering the interior surface immune to sulphur corrosion, and the protection of the exterior surface against oxidation.

In the application of the process to seamless tubing, the aluminum is driven into the surface layer of the steel, forming an iron-aluminum alloy. It is this alloy, which is an integral part of the steel, that resists both oxidation and corrosion. The alloy surface is much harder than mild steel, and under the action of the tube cleaner, acquires a high polish.

In calorizing the inner and outer surfaces of cracking still tubes, the tubes are thoroughly hot-pickled after annealing to remove any traces of scale, and are then inspected at the mill. They are next sand-blasted and wire-brushed to provide smooth clean surfaces and then charged into a cylindrical retort and packed in a calorizing compound, which is uniformly distributed on both the interior and exterior surfaces. Fig. 1 shows one of the retorts being charged with tubes. The charged retorts are hermetically sealed by bolting on the heads. An atmosphere of hydrogen is maintained in the retort during the entire process. In Fig. 2, one of the retorts is shown being lowered into position in the calorizing furnace.

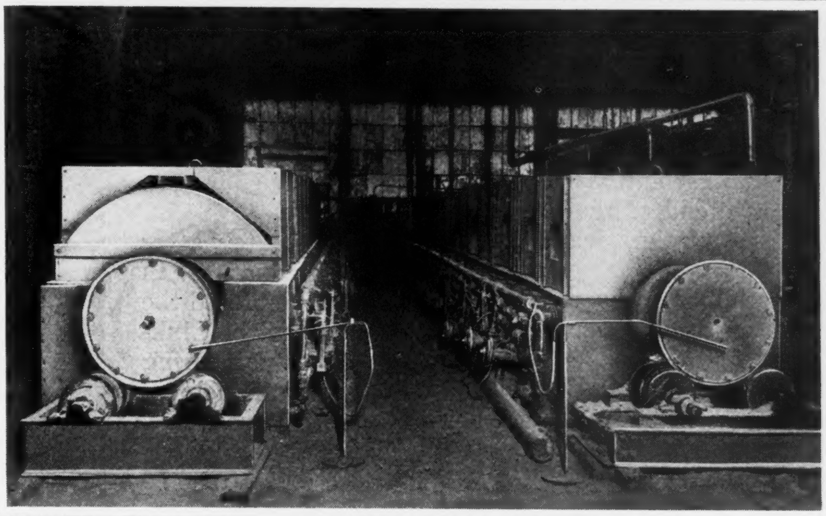


Fig. 3. Charged Calorizing Furnaces in Operation

Construction of Calorizing Furnace for Revolving Retorts

The calorizing retorts shown in the illustration are 24 1/2 inches in diameter, and are made in 30- and 35-foot lengths. During the entire heating operation, the retort is revolved within the furnace. The heat is provided by four gas-fired units, approximately 35 feet long by 5 feet wide by 6 feet high. These units use natural gas, and were designed and built by the Surface Combustion Co., Toledo, Ohio. The cylindrical steel plate shells of the furnaces are lined with 9-inch firebrick. The body of the furnace is made with removable 3-foot and 6-foot sections to accommodate either length of retort.

The furnace tops are built in 6-foot sections, and are removed for putting in or taking out the retorts. The tops consist of 2 1/2 inches of "Sil-O-Cel" and 9 inches of firebrick, carried in a steel frame. These sections, together with the bottom

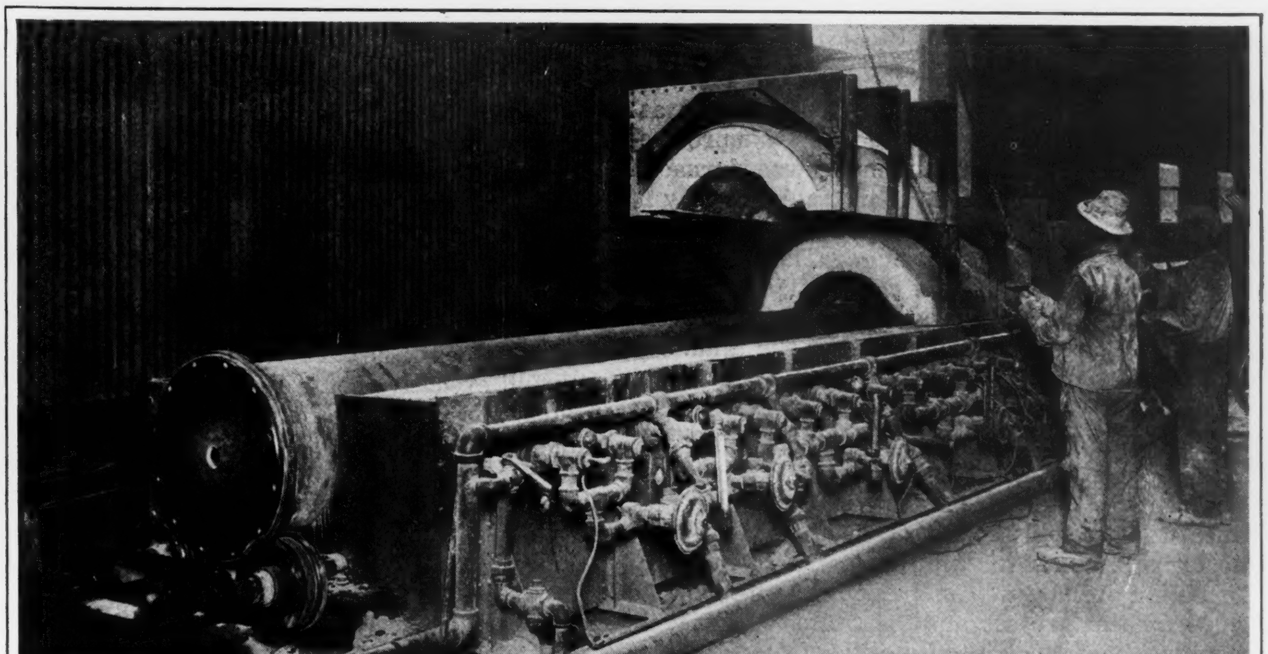


Fig. 4. Replacing Top Sections of Furnace to Enclose Retort

and side retaining members, are held together by a structural steel frame and are provided with a top ring to facilitate handling with an overhead hoist, as shown in Fig. 4.

Each furnace is fired by twenty-three gas burners located on one side. Seven thermo-couples extending into each combustion chamber are connected with an indicating switchboard type pyrometer, so that the temperature can be accurately checked at any point.

A base provided with chilled iron rollers is located at each end of the furnace, and the retorts are carried by flanges which rest on these rollers. The rollers at the end of the furnace shown in Figs. 2 and 4 are driven by a five-horsepower motor through speed reduction gears, which give speeds ranging from 1 to 3 revolutions per minute. The rollers at the opposite end of the furnace, as shown in Fig. 3, are simply idlers which support the end of the retort.

The gas burners are connected by manifolds to inspirators which maintain the proper mixture of gas and air for efficient combustion. Any furnace atmosphere may be had with this system, but for the class of work described, a neutral atmosphere is essential in order to minimize the scaling of the retorts which are subjected to an operating temperature of 1740 degrees F.

Time Required for Calorizing Operation

It requires from four to four and one-half hours to bring the retort and furnace up to the operating temperature, and the gas consumption for this and the five-hour soaking period averages 33,000 cubic feet. A charge in the longer retort includes 3750 pounds of steel and 3000 pounds of calorizing compound. This, together with the 11,000-pound retort, brings the total weight of the furnace charge up to 17,750 pounds. After shutting off the gas, it takes two hours for the retort to cool.

Dip Calorizing Process

Smaller work, of irregular shape, is subjected to a modification of the calorizing process, known as "dip calorizing." The essential unit in this process consists of a tank set in an under-fired furnace. The approximate dimensions of the tank are 2 by 2 by 10 1/2 feet long. This tank has a capacity of 5000 pounds of molten aluminum. There are two burners on each side of the combustion chamber fired through a perforated arch to obtain an even distribution of heat on the bottom of the tank.

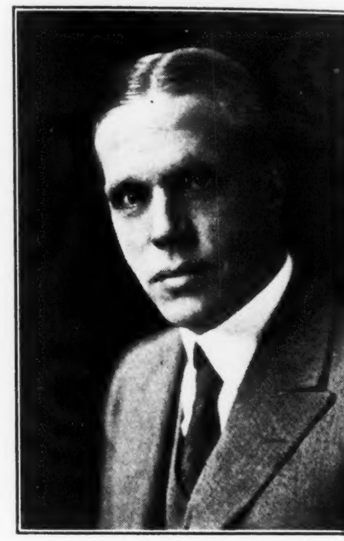
* * *

To end the uncertainty that has always been encountered by trans-Atlantic flyers, weather officials of the United States, Great Britain, Germany, and France will assemble soon in Copenhagen to complete arrangements for an international weather information exchange. Congress has appropriated $30,000 for this project, and the United States will receive weather reports twice a day from Europe, these reports to be based on radiograms sent from ocean liners.

CHARLES PIEZ ELECTED PRESIDENT OF THE A. S. M. E. FOR 1930

Charles Piez, chairman of the board of the Link-Belt Co., Chicago, Ill., has been elected president of the American Society of Mechanical Engineers. He will take office at the annual meeting in December this year and will serve during 1930.

Mr. Piez was born in Germany in 1866 of naturalized American parents, and grew up in the United States. He received his engineering education at the School of Mines of Columbia University. Like many other men who later have become leaders in the business and engineering world, his education was paid for largely through his own earnings.



Charles Piez, Newly Elected President of the American Society of Mechanical Engineers

Immediately after his graduation in 1889, he entered the employ of the Link-Belt Engineering Co. in Philadelphia as a draftsman. Seventeen years later, in 1906, after he had attained the position of chief engineer and general manager of the Philadelphia Works of the company, he was elected president of a consolidated organization of three related companies, the Link-Belt Machinery Co. of Chicago, the Ewart Mfg. Co. of Indianapolis, and the Link-Belt Engineering Co. of Philadelphia. The consolidation was named the Link-Belt Co., and under Mr. Piez's management has become widely known as a successful engineering and manufacturing enterprise. In 1917, Mr. Piez was appointed vice-president and general manager of the United States Shipping Board Emergency Fleet Corporation to carry out the nation's shipbuilding program. Charles M. Schwab, later chosen director general of this corporation, and Mr. Piez were associates and friends in their efforts "to bridge the seas with ships." On May 1, 1919, Mr. Piez resigned to return to private business.

He continued as president of the Link-Belt Co. until 1924, when he became chairman of the board with full executive control of the company and its various subsidiaries. He is also president of the Commercial Club of Chicago, a director of the State Bank of Chicago and of the Drexel State Bank of Chicago, a member of the executive committee of the Museum of Science and Industry founded by Julius Rosenwald, and a member of the following engineering societies: The American Society of Mechanical Engineers, the American Institute of Mining and Metallurgical Engineers, the Society of Naval Architects and Marine Engineers, and the Western Society of Engineers.

THE BRITISH METAL-WORKING INDUSTRIES

From MACHINERY'S Special Correspondent

London, October 16, 1929

The conditions prevailing in the British metal-working industries as a whole reflect the steady progress that has characterized the present year, and now that vacations are over, renewed activity is to be observed in almost all branches.

The Machine Tool Industry is Well Employed

Almost without exception, machine tool makers are well employed, and in many cases, orders already in hand will insure the works being occupied fully until the end of the year. This satisfactory state of affairs is due to the continued demand for up-to-date machine shop equipment from all branches of the metal-working industries, and augurs well for the future of industry as a whole.

In the Birmingham district, machine tool manufacturers find the home demand particularly good, while some very important business is being negotiated on the Continent at present, largely on behalf of the French automobile industry which is expanding very rapidly. A special feature of the situation in the machine tool industry is the fact that large numbers of heavy machines and machines of special types are included in recent orders, in addition to the usual standard ranges. Among machine tools for which the demand is particularly good, mention may be made of heavy lathes for railway wheel work; traversing-head and pillar type shapers; planer type and vertical milling machines; and grinding machines.

Overseas Trade in Machine Tools Increases

The returns for the month of August show that the exports of machine tools were well above the average, both in tonnage and value, while the ton value was well maintained. Actually 1437 tons of machine tools were exported during August, with a total value of £200,693, and a ton value of £140. The corresponding figures for July were 1228 tons, having a total value of £174,031, and a ton value of £142; and for June, 1004 tons, with a total value of £150,236 and a ton value of £150.

Except for the month of July, the value of machine tools imported has shown a steady upward trend since February, while the imported tonnage remains steady. During August, 998 tons of machine tools were imported, the corresponding total value being £196,362, with a ton value of £197. The tonnages imported during June and July were 877 and 833, the respective total values being £178,841 and £171,483, and the ton values, £204 and £206.

Motor Show Features Light Cars

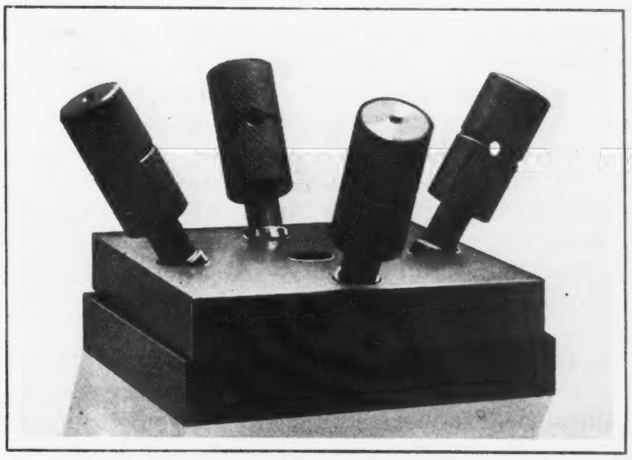
Interest in the automobile industry at the present time is chiefly centered in the Motor Show which will be held at Olympia during the latter part of the month. The chief feature of the show will be the increased number of light and medium-powered six-cylinder cars. In many cases, manufacturers are introducing six-cylinder models in place of, and not in addition to, four-cylinder cars of approximately the same capacity.

* * *

AN ACCURATE JIG BORING OPERATION

At the National Metal Exposition held in Cleveland during the second week in September, an interesting demonstration was made of the use of an inclinable rotary table on a Société Genevoise jig boring machine. The results of the demonstration are shown in the accompanying illustration. Four holes, inclined at a 30-degree angle and all pointing toward the center, were drilled and bored in two cast-iron plates about 6 inches square and 1 inch thick.

The finished holes were 3/4 inch in diameter. They were bored by means of end-mills, cutting on the end only to correct the holes produced by the drills, which left about 0.010 inch of stock for finish. Each plate was drilled and bored separately. The upper plate, which was drilled first, was carefully calipered to determine its thickness, and then the amount the carriage should be moved to locate the holes correctly in the lower plate was determined by a simple calculation. The location of the holes in the lower plate was to be such that the two plates could be assembled together with plug gages, as shown. The surfaces of the upper plate were out of parallel 0.001 inch; allowance was made for this in making the calculation.



Two Plates Bored Separately on a Jig Boring Machine with Plug Gages Inserted through the Holes in Both Plates

After the holes in the second plate had been bored, the results were so accurate that the two plates could be plugged together with 3/4-inch plug gages having a clearance of about 0.0001 inch—and what is more, the two plates could be placed together in any of the four possible positions, and the plugs would fit. If, however, thin pieces of tissue paper 0.0013 inch thick were placed between the two plates at opposite corners, the plug gages could not be inserted through them.

No definite record was kept of the time in which these holes were bored except that it was recorded that the lower plate was finished in less than an hour.

Information the Machine Tool Buyer Needs

What Information the Machine Tool Salesman Must Supply—Other Important Subjects Discussed at the Second Machine Tool Congress

ONE of the important subjects presented at the second Machine Tool Congress, held in Cleveland September 30 to October 4, concurrently with the Machine Tool Exposition, related to the information the machine tool buyer needs from the machine tool salesman. This timely subject was assigned to George T. Trundle, Jr., president of the Trundle Engineering Co.

In purchasing equipment, Mr. Trundle pointed out that the buyer first wants to know that the machine tool is made by a reliable firm—reliable financially as well as in ability to design and build. Second, the buyer wants to know that the machine is not an infringement on some other patent. Since it is not humanly possible for any manufacturer to say that his product is free from infringement, the manufacturer must be financially able to protect the buyer. The buyer also has additional security if he is buying the machine from a reliable agent. Third, the buyer wants facts concerning what can be expected from the machine in the way of production. Fourth, he wants to know what delivery can be expected. Fifth, information is needed relating to the range of feeds and speeds, and whether the buyer's standard equipment, such as arbors, chucks, fixtures, etc., will fit the machine. The size and design of the spindle, the kind of bearings and gears used, and the type of drive for the machine are also important. The buyer generally is particularly interested in knowing whether sufficient power can be applied to operate the machine at full capacity. Another mechanical fact of importance relates to proper machine lubrication.

In considering production, Mr. Trundle referred to the importance of basing production estimates upon a clear understanding of the nature of the work. The salesman is often given a blueprint of the part to be machined, so that the machine tool manufacturer can estimate on production. This blueprint may specify anywhere from, say, 1/32 to 1/8 inch for finishing, whereas the actual part may not have sufficient stock or it may have two or three times the amount the blueprint specifies. The part to be machined may also be hard or soft, or full of blow-holes or hard spots. Then too, there are various differences of opinion as to the type of finish a certain part should have, a finish that is entirely satisfactory in one plant not being satisfactory in another. The drawing may also specify a tolerance of, say, 0.0003 inch for a reamed hole, when in reality the buyer is manufacturing the part within a tolerance of 0.002 or 0.003 inch with satisfactory results. All of these factors have, of course, a direct bearing upon the production that may be expected from a machine tool, so that the buyer who relies entirely upon a blueprint may expect trouble. The reckless machine tool salesman tends to assume ideal conditions and guarantee a higher production than is warranted. The buyer, however, is looking for production and is likely to purchase the machine that promises the greatest output. The plan advocated is for the buyer to give the *facts* to the machine tool salesman and to actually show him the work for which the machine is needed.

Reference was made to the unreasonable production demands expected by some machine tool buyers. For example, it has not been uncommon for purchasing agents and higher executives to adopt the general policy of not buying tool equipment unless it will pay for itself in one year or less. The fact was emphasized, however, that the great prosperity of the industries in the United States has not been built up on that kind of reasoning. "In fact, the buyer who actually lives up to a fixed policy of never buying equipment unless it pays for itself in one year or less, is," said Mr. Trundle, "losing money and is headed straight toward bankruptcy"; in this connection, it was mentioned that not more than 10 per cent of the machine tools sold pay for themselves in less than two years.

The second of the four sessions of the Machine Tool Congress was devoted to the subject "The Present Status of Cemented Tungsten-carbide Tools and Dies." Dr. Zay Jeffries, consulting engineer of the General Electric Co., was the speaker. Information was given concerning the properties of tungsten-carbide and how it is being used in numerous lines of manufacture not only to greatly increase cutting speeds, but to make possible the machining of materials heretofore considered unmachineable. It is estimated that in Europe and America combined there are over 400,000 cemented tungsten-carbide tools in use.

The first two sessions of the Congress were under the auspices of the Machine Shop Practice Division of the American Society of Mechanical Engineers, whereas the third and fourth sessions were under the auspices of the Production Committee of the Society of Automotive Engineers. The subject for the third session was "Economic Production Quantities," and the speaker, Professor F. E. Raymond of the Massachusetts Institute of Technology. The fourth session consisted of a Production Forum, and the following subjects were presented: Application of Standard Machine Tools to Automobile Manufacture; Results in Production Due to New Features of Machine Tool Construction; Synchronizing Automobile Parts at the Assembling Line; and Basis of Replacing Machine Equipment.

New Shop Equipment

A Monthly Record of the Latest Developments in Metal-working Machinery, Small Tools, and Work-handling Appliances

CLEVELAND HYDRAULIC CHUCKING MACHINE

A five-spindle 7-inch Model M automatic with hydraulically operated chucks has recently been developed by the Cleveland Automatic Machine Co., 2269 E. 65th St., Cleveland, Ohio, for rapidly machining castings, forgings, etc., in first and second operations. This method of chucking makes the machine entirely self-contained, aside from the power necessary for driving it. Accessibility is another feature of the construction, it being possible to do all the tooling up from the front of the machine.

The hydraulic chucks are conformable to variations in the diameter of work and at the same time provide a positive force sufficient to hold the work pieces against the maximum cutting feed of the tools. The chucks can be adjusted to exert a light grip on work that might become distorted by a powerful grip or uneven pressure.

The barrel type of tool turret employed, following the conventional design of the Models A and M machines, moves back and forth on the tool turret housing. An extra attachment for the tool turret permits tool combinations

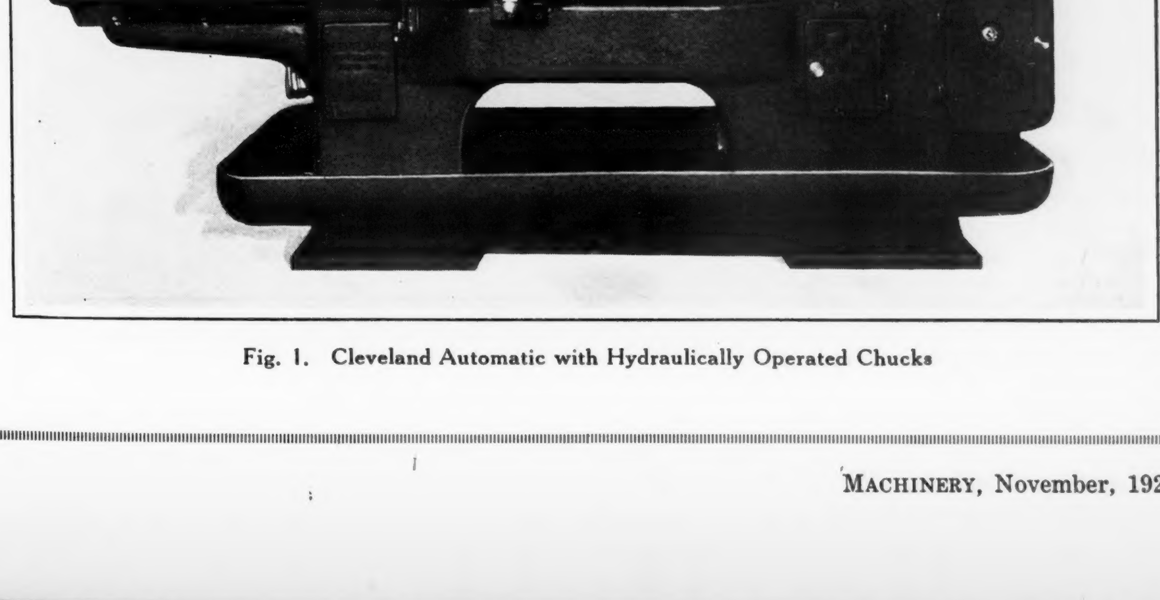


Fig. 1. Cleveland Automatic with Hydraulically Operated Chucks

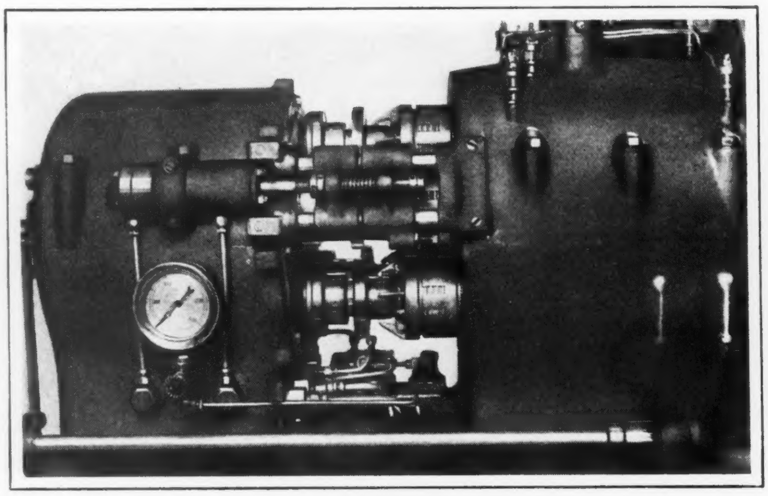


Fig. 2. Close-up View of the Hydraulic Chuck-operating Mechanism on the Cleveland Automatic

to be employed that would be complicated if carried out in one tool design. Three forming slides are provided as standard equipment. The two lower slides at the front and rear operate independently of each other. A double top slide mounted on the spindle turret cap affords two forming stations in the third and fourth positions.

The tooling sequence of the standard machine provides for standard tools in positions Nos. 1 and 2 which advance with the turret at the same feed per revolution. In positions Nos. 3 and 4 (upper rear and top) the tools are clamped in independent revolving spindles which move longitudinally in the tool turret, but are individually controlled by cam-operated levers. The loading station, which is the upper front, or fifth, position, is also independently controlled. Spindles Nos. 3, 4, and 5 can be cammed to complete their operation ahead of or at the same time as the other cutting tools. Threading, tapping, or extra revolving spindles can be furnished.

The hydraulic unit consists of a high-pressure variable delivery pump, a low-pressure gear pump, a stroke control lever, a pressure changing mechanism, and a built-in control valve. This unit is mounted in the oil supply reservoir and is driven at a constant speed. The pressure regulator can be adjusted while the machine is in operation, and affords a pressure variation of from 0 to 1000 pounds per square inch.

A single automatic valve, for which a patent application has been filed, is located at the rear of the spindle turret between the work-spindles. It is connected directly to individual oil cylinders, one of which is mounted on each spindle, and thus controls the opening and closing of the chucks. This five-way valve is so designed that a constant pressure is maintained on four of the cylinders, while the fifth is operated for opening and closing the corresponding chuck. Either hand or automatic operation of the cylinders is available.

The stop spindle mechanism is entirely automatic, and is controlled from an independent oil cylinder mounted between the spindle turret and the hydraulic unit. It is operated through an independent oil line, engaging and disengaging the spindle drive clutch, and at the same time, applying the spindle brake mechanism to stop the spindle rotation. Twenty spindle speeds, ranging from 61 to 756 revolutions per minute are available through change-gears. The tool feed per revolution of the work is constant.

BARBER-COLMAN HOBBING MACHINE

The principal features of a Type B production hobbing machine recently introduced to the trade by the Barber-Colman Co., Rockford, Ill., include simplified gearing and drives; generous use of roller and ball bearings; a worm-gear final drive to the hob; a hob-spindle drive outside the bed, which permits the hob

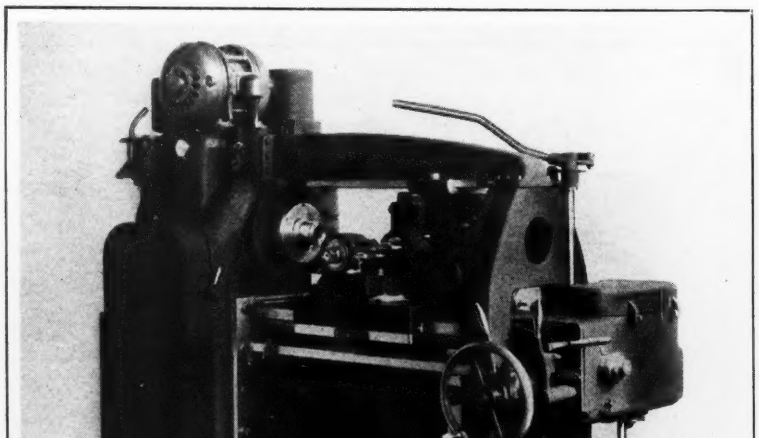


Fig. 1. Barber-Colman Hobbing Machine Embodying Improved Features

to be swiveled on a center under the work; a work-spindle mounted in a housing held fast to the base, the work diameter being controlled by an elevating bed; a unit pressure oiling system; automatic continuous lubrication of the feed-box; a power rapid traverse of the hob slide; centralized interlocking controls; a screw and micrometer dial for positioning the hob; and a direct-connected motor drive.

The main frame consists of a heavy base casting which also serves as an oil reservoir. At one end of this base is set the main upright, which carries the driving and indexing elements and the main work-spindle as a complete unit. There is a second heavy upright at the outer end of the main base. The inner faces of both uprights are machined and form a parallel open-sided box in which the hob-carriage main bed is raised and lowered. This construction permits accurate adjustments to be made to suit the diameter of the work, and at the same time provides the necessary rigidity for high production.

The work-spindle is mounted in Timken tapered roller bearings. The front end of the standard spindle is machined to a No. 12 B & S taper; however, the hole through the spindle and the spindle face can be so made as to permit the holding and driving of a variety of work. Indexing of the work-spindle is accomplished by means of a steel worm which drives a bronze worm-gear of large diameter.

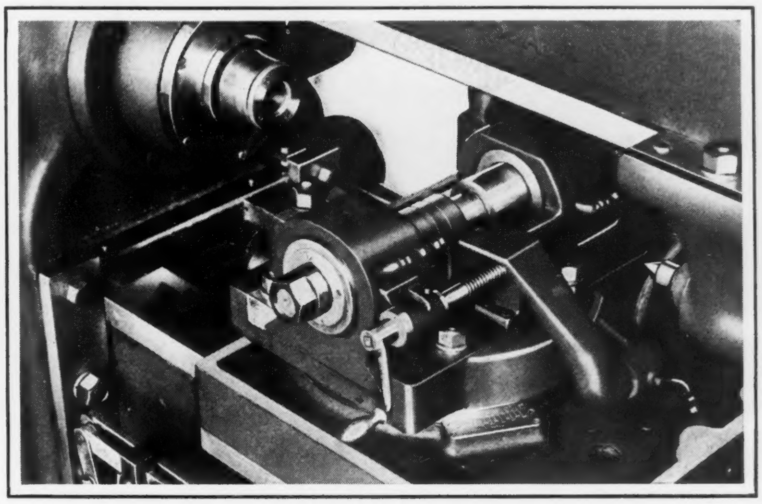


Fig. 3. Hob Carriage from the Front, Showing the Hob-positioning Screw and Micrometer Dial

The hob-spindle is also mounted in Timken tapered roller bearings. The hob slide is accurately adjusted by means of a screw to position the hob endwise, and is then clamped in place. The drive to the hob-spindle is also through worm-gearing. Swiveling of the hob on a center directly under the work to obtain the proper setting has been arranged for by separating the worm-gear case and the bevel-gear case, which slides on the main drive-shaft, and joining them with a heavy swivel fit. Fig. 3 shows a view of the hob carriage from the front of the machine.

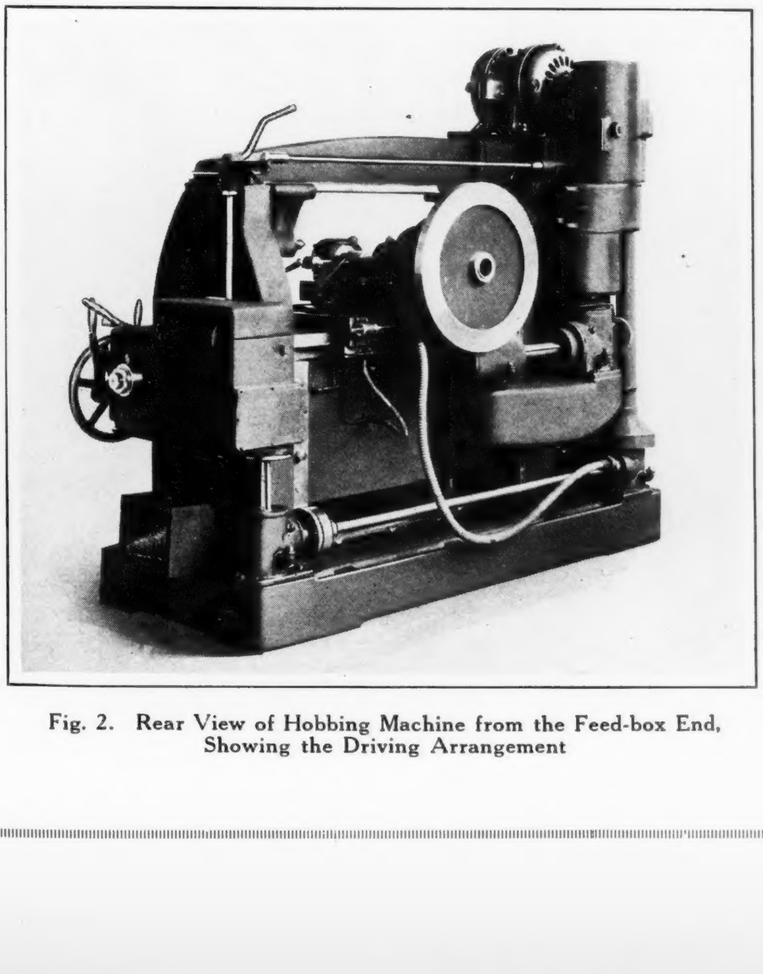


Fig. 2. Rear View of Hobbing Machine from the Feed-box End, Showing the Driving Arrangement

The motor is direct-connected by bevel gears. In addition to the motor controls, an automatic stop on the machine operates a friction driving clutch interposed between the motor gears and the drive change-gears. The feed-box is driven by an independent shaft that runs continuously. This shaft provides power through the feed change-gears for any selected feed, or through reversing gears for the quick traverse of the hob slide in either direction.

Important specifications of this machine are as follows: Minimum and maximum center distances between the work-spindle and hob, respectively, 2 and 8 inches; maximum travel of hob carriage, 16 inches; maximum diameter of hob, 4 1/2 inches; range of feeds, from 0.081 to 10.720 inches per minute; and range of hob speeds, from 55.1 to 159.4 revolutions per minute.

AMERICAN VERTICAL BROACHING MACHINE

The latest development of the V-50 vertical broaching machine to be placed on the market by the American Broach & Machine Co., Ann Arbor, Mich., is shown in the accompanying illustration. This machine is now available in four sizes, of 12, 25, 35, and 50 tons. The machine is of the two-cylinder pull type, and is operated semi-automatically by hydraulic pressure.

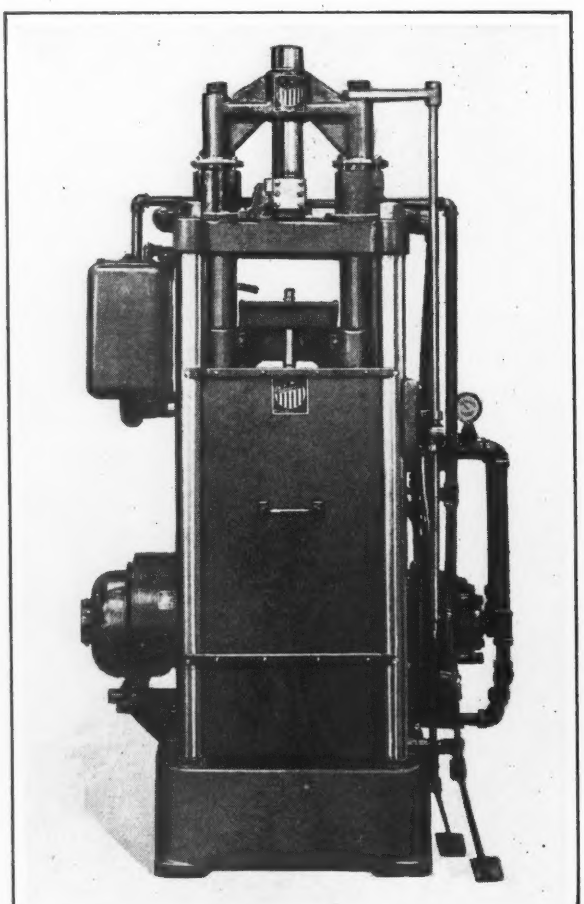
In operation, the work is simply placed over the shank of the broach, and one of the foot-pedals depressed. This connects the broach with the pull-head, and automatically starts the broach on its upward or working stroke. If desired, however, the machine can be set so that a second pedal must be depressed to start the upward movement after the broach is connected to the pull-head. When the broach has completed its cut, the work drops to the angular table and slides down a chute to a tote box at the rear of the machine. On the reverse stroke, the rams return to within 5 inches of the bottom position, where the broach is automatically released.

The pump that provides the oil pressure required for operating the two rams of the machine is submerged in the oil supply tank. The complete hydraulic system is of the company's own design, and it is claimed that continuous operation will not cause the oil temperature to rise above the proper operating point. The 12-ton machine has sufficient space between the two cylinders to permit broaching pieces up to 13 inches in diameter. Cutting speeds from 0 to 30 feet per minute are available with a quick return of any speed up to 80 feet per minute.

Broaches up to 50 inches in length can be used, and two or more broaches may be employed simultaneously. The machine can also be equipped for spiral broaching. The operating pressure is set for 1000 pounds per square inch. The machine occupies a floor space of 4 by 6 feet, and weighs 6400 pounds.

BARNES DRILL CO.'S DRILLING AND TAPPING MACHINE

The No. 221 1/2 production-type self-oiling all-geared drilling and tapping machine being placed on the market by the Barnes Drill Co., 814 Chestnut St., Rockford, Ill., is provided throughout with anti-friction bearings. Timken tapered roller



American Semi-automatic Hydraulic Vertical Broaching Machine

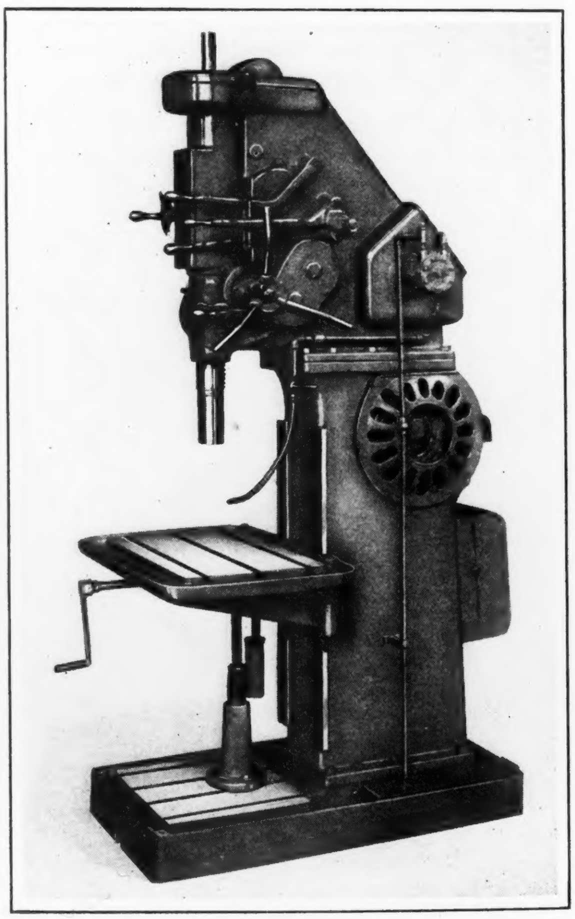


Fig. 1. Drilling and Tapping Machine Brought out by the Barnes Drill Co.

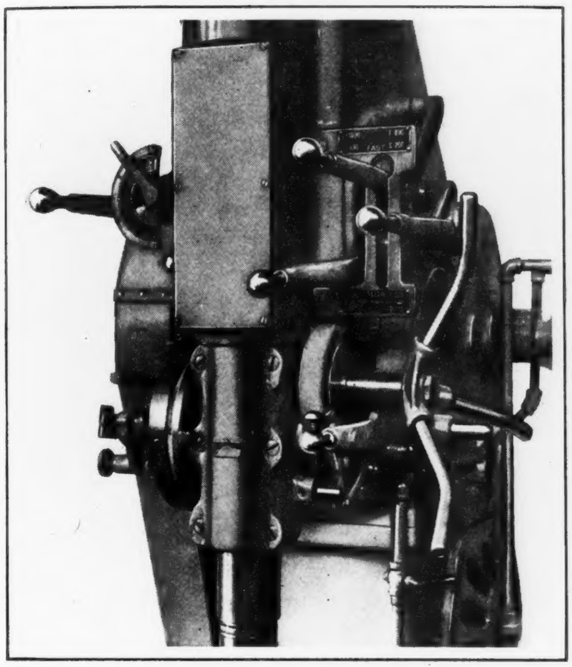


Fig. 2. Close-up View of the Speed and Feed Levers and Indexing Plates

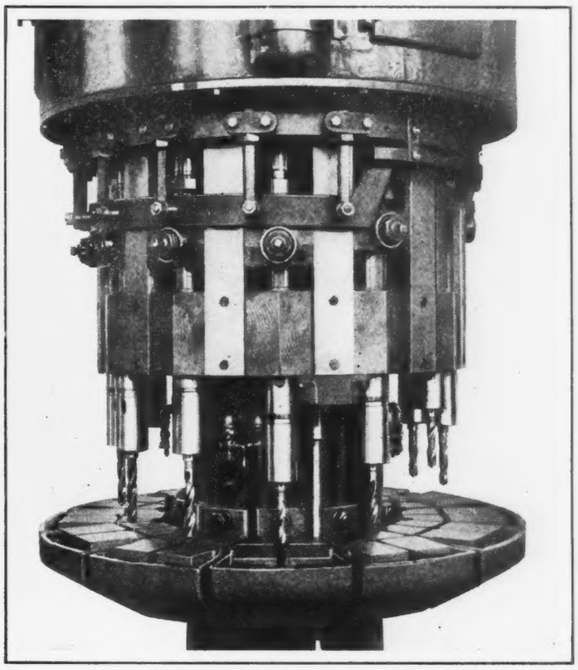


Fig. 1. Automatic Feeding Arrangement on Davis & Thompson Continuous Drilling Machine

bearings are used for all speed-change shafts and for the spiral crown gears; ball bearings are provided for the drive shaft and for the handwheel shaft; and a Rollway roller bearing is furnished for taking the spindle thrust. The machine has a capacity for drilling up to 1 1/2 inches through solid mild steel, and has a swing of 22 inches.

Eight quick-change gear speeds are available through control levers that extend to the front of the machine, and eight spur gear feeds can also be quickly obtained through conveniently located levers. All speeds and feeds are indicated on brass plates for each setting of the levers, as illustrated in Fig. 2.

The spindle and sleeve are made of "Nitralloy" steel, and hardened, after machining, by the Nitriding process, which gives a hard case about 1/32 inch deep. This enables the spindle to be mounted in self-oiling roller bearings with the rollers in direct contact with the hardened surfaces of the spindle and sleeve. No case or raceway is used, the rollers being held in a cage and inserted in a recess at each end of the steel sleeve. The diameter of the sleeve is thus held to 3 1/4 inches. Application has been made for a patent on this construction.

The rack teeth are cut integral with the sleeve, and torque is taken by hardened collars on a cross-spindle, the collars rolling in a milled channel at each end of the rack teeth. This construction is also patented.

A graduated ring or collar mounted on the internal gear can be set to give the required length of spindle travel. The machine illustrated is equipped with a guarded "Texrope" drive; however, a silent chain drive or a tight pulley may be supplied. Some of the principal specifications are as follows: Maximum distance from No. 4 taper spindle to regular table, 31 inches; maximum distance from spindle to base, 46 1/2 inches; vertical travel of spindle, 14 inches; vertical travel of table, 23 inches; and weight with coolant pump and motor drive, 2700 pounds.

The same concern has also developed a No. 242 drilling and tapping machine of the same general construction as the one described, with a capacity for drilling holes up to 2 inches in mild steel. With a coolant pump and motor drive, this machine weighs about 3250 pounds.

DAVIS & THOMPSON VERTICAL CONTINUOUS DRILLING MACHINE

A twelve-spindle continuous drilling machine of vertical type has recently been built by the Davis & Thompson Co., 57th Ave. and Mitchell St., Milwaukee, Wis., for drilling overhead valve levers, pedals, and similar parts used in the construction of tractors and automobiles. The machine has a capacity for drilling 1 1/2-inch holes in steel. The drilling speeds are regulated through pick-off gears. The drills are fed into the work as the work-table revolves, by means of rollers running along an adjustable cam.

In Fig. 2 a lever can be seen projecting downward from the top of the machine; this lever is employed for starting and stopping the rotation of the work-table. The adjustable cam is bolted to the machine by means of clamps and nuts, as shown in Fig. 1. The bolts are flattened on one side and graduated in fractions of an inch to aid the operator in adjusting the cam when changing from one

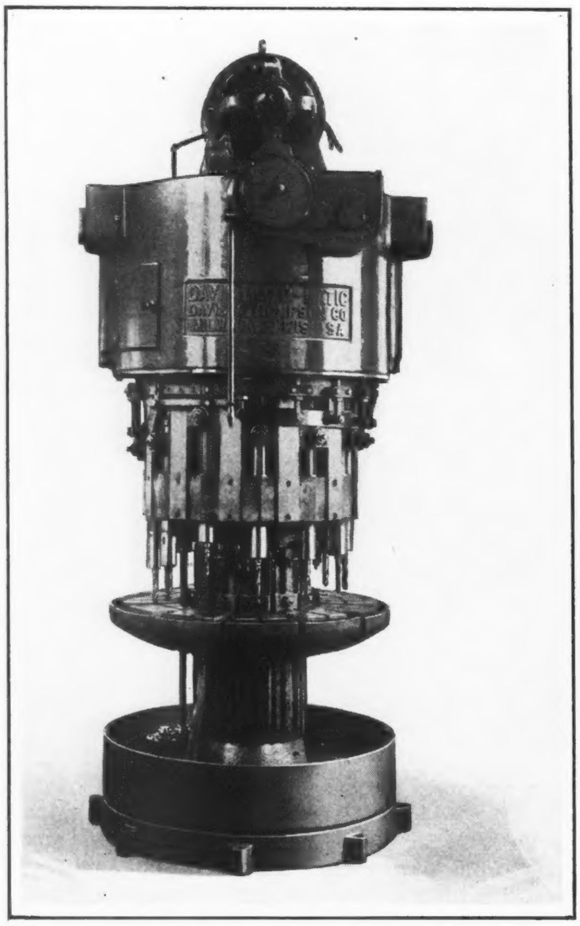


Fig. 2. Davis & Thompson Continuous Drilling Machine of Vertical Design

Hoefer Machine with Continuously Rotating Work-table and Spindle Units

depth of hole to another. The drilling depth can be varied from 1/2 to 6 inches or more. The rollers are held against the cam by spring tension.

Located in the pan of the machine is a centrifugal pump which furnishes lubricant to the work-pieces when drilling steel or malleable iron. When gear blanks are being drilled, a universal chuck is placed on the table for chucking the parts. The machine can also be built with less than twelve spindles if desired. The spindles have a vertical movement of 12 inches and the maximum distance between the spindles and the table is 30 inches. The machine is equipped with ball bearings throughout, and weighs about 20,000 pounds.

HOEFER CONTINUOUSLY ROTATING MACHINE

A continuously rotating 5- to 7 1/2-horsepower high-production type of machine, recently designed by the Hoefer Mfg. Co., Inc., Freeport, Ill., is a direct development of the indexing type of machine built by this concern, which was described in November, 1927, MACHINERY, page 243. The basic machine is identical, but in place of the multiple-spindle head equipment of the indexing machine, a dome is fastened directly against the main head in the continuously rotating machine. This dome contains two horizontal cams, one for actuating the downward travel of the spindle units and the other for withdrawing these units.

A constantly rotating table is mounted on a heavy knee type support. Fastened to the table is a four-sided column carrying four slides on each of which a single-spindle unit operates. The upper part of the column has a large bearing in the dome. As the table rotates, together with its column and the spindle units, the spindle units are given up and down movements by means of the horizontal cams. Contact between the spindle units and the cams is through the medium of large hardened rollers mounted on roller bearings. The sequence of feed is first a rapid approach, then a working feed, and finally a rapid withdrawal. A dwell can be provided at the end of the working feed if desired.

Four holding fixtures are mounted on the table to meet the requirements of the job. These fixtures can be easily replaced in changing the machine for different kinds of work. The table with its column, spindle units, and fixtures rotates as a unit through 270 degrees during the

operation, 90 degrees of rotation being assigned to reloading the work. Spindle speeds and the speed of table rotation can be changed by means of pick-off gears. The head units are provided with a vertical adjustment for maintaining a uniform depth of cut. Counterbalancing springs ease the upward movement of the spindle units.

While this machine is primarily intended for single-operation work, it is often possible to use combination tools, as, for example, when it is desired to perform facing and countersinking operations simultaneously. Also, when groups of holes are to be drilled in parts, small multiple-spindle heads can be mounted on the spindle units.

FEDERAL PUNCH PRESS

A punch press designed to produce large work from light material, or to accommodate long progressive dies, is the latest development of the Federal Press Co., Elkhart, Ind. This No. 33 press has the advantage of large die space and bed area, and operates at high speed. There is an opening in the bed for the parts or scrap to drop through.

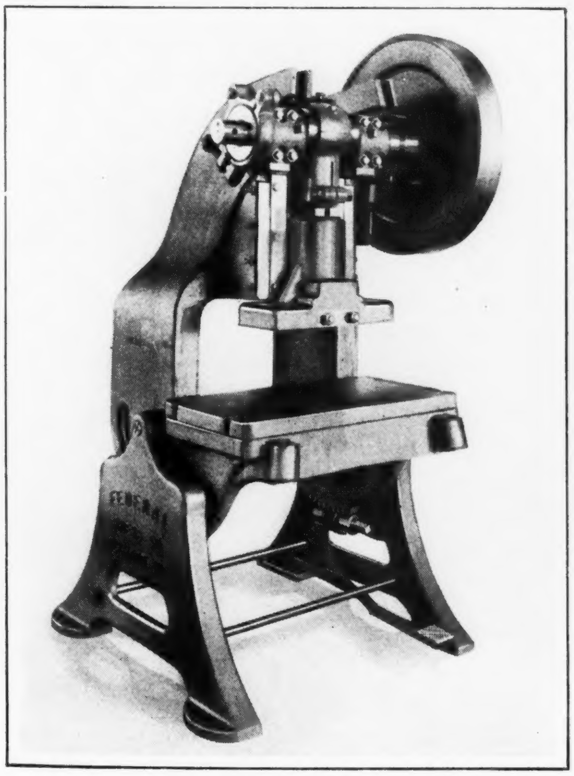
Some of the principal specifications of this machine are as follows: Speed of flywheel, 125 revolutions per minute; pressure of ram near bottom of stroke, 26 tons; standard stroke, one inch; maximum stroke (at extra cost), 1 1/2 inches; maximum adjustment down from top, 2 inches; size of oblong bed opening, 21 by 6 inches; size of opening through back, 20 1/2 inches; depth of throat from center of ram to frame, 8 3/4 inches; die space from bed to slide, down stroke, adjustment up, 9 1/4 inches; and weight of machine, 3100 pounds.

WESTINGHOUSE LINE-STARTER WITHOUT CABINET

In some machinery applications, it is desirable to mount the motor starter within the machine, and in this case, the cabinet is not required. For such services, the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., now supplies an improved line-starter without a cabinet. Like the company's other line-starters, this starter is equipped with the deion arc quencher and the thermal overload relay. The automatic reset of this relay makes it unnecessary for the operator to go to the starter and put the motor back on the line after an overload. These improved features add to the safety of operation. The new line-starter is available in three sizes, up to 50 horsepower.

LAIDLAW METAL-CUTTING BAND SAW

Both sides of a metal-cutting band saw, developed by William Laidlaw, Inc., Belmont, N. Y., and shown for the first time at the National Machine Tool Builders' Exposition, are used simultaneously for cutting work. While primarily intended as a



Federal Punch Press Designed to Handle Large Light Work

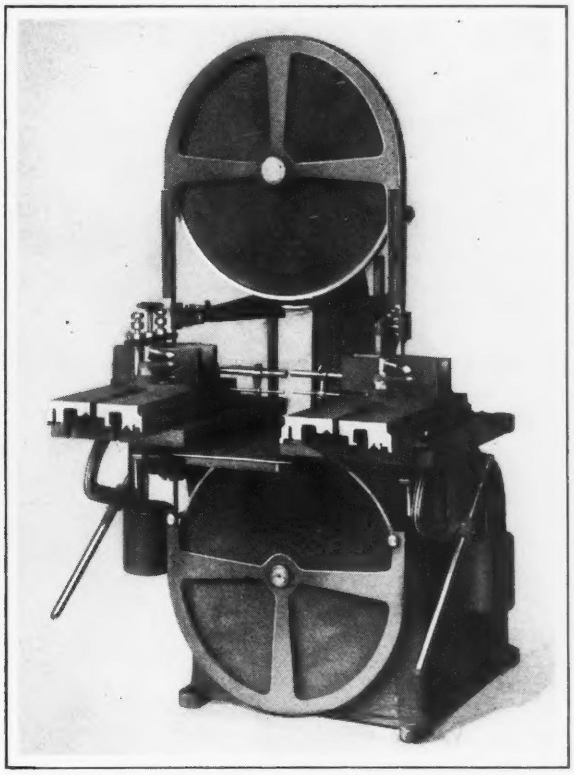


Fig. 1. Laidlaw Band Saw which Cuts on Both Sides of Machine

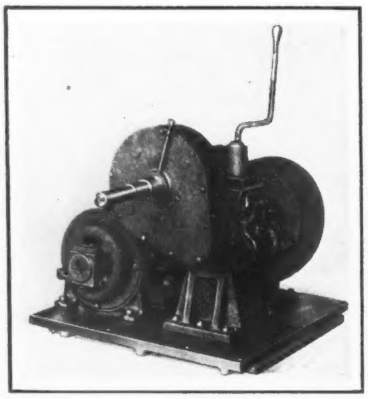


Fig. 2. Self-contained Transmission Unit of Band Saw

production machine for cutting either long or short pieces, this CMT machine is readily adaptable for special jobs and can be used to advantage on a variety of sizes and shapes.

A good example of special operations that can be performed with this saw is the cutting of tools requiring both rake and clearance. Tools can be cut in double lengths from nested bars on one side of the machine. Simultaneously, by using a simple fixture on the other side of the machine, these double lengths can be cut in two at a compound angle to give the correct rake and clearance, without further machining before hardening.

The band saw runs in the center of the vises and carriages. Either side of the machine can be set almost instantly for cutting at any angle. An automatic stop prevents the saw from cutting into the vises. Another feature of the machine is the use of swivel tables that enable all pieces up to 30 inches long to be cut without twisting the saw. Longer pieces can be cut with a twist of only 15 degrees.

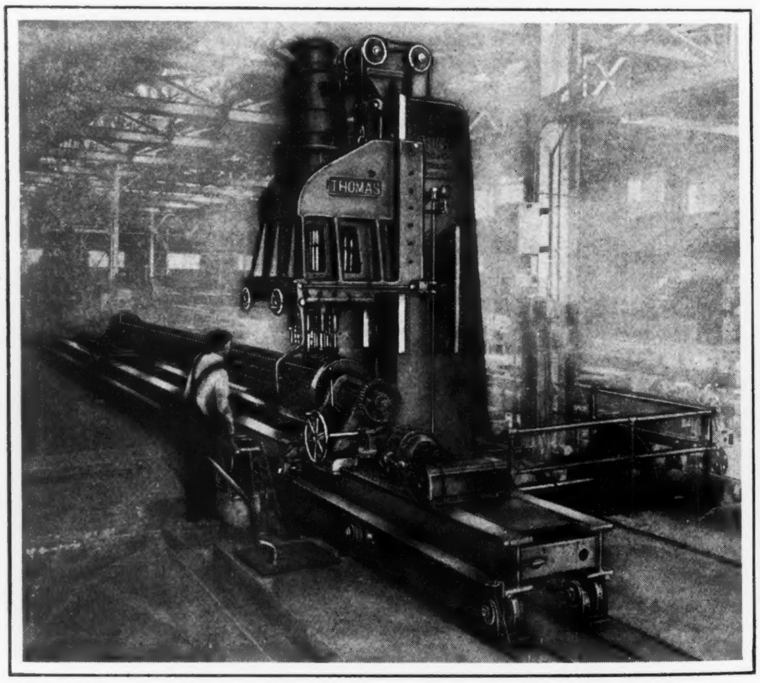
Quick-action vises requiring no wrenches are mounted on carriages supported on steel balls and traveling in machined ways. The carriages are held down by annular ball bearings contacting with a special inverted way that has an adjustment for taking up wear. There is also a downward clamping device. These two features prevent both the work and the work-holding members from being raised on the left or up-cutting side. The saws can be readily changed without removing the guards.

The power unit, which is shown in Fig. 2, consists of a motor, speed reducing gears, and a four-speed sliding-gear transmission. It is mounted on a separate plate and housed in the base of the machine. The entire unit is equipped with ball bearings, and all gears and bearings run in oil. Four speeds are obtainable by means of a shift lever which extends upward through the frame casting into a position convenient to the operator. In cutting bar stock, the machine has a capacity for work 12 by 12 inches in size.

THOMAS MULTIPLE-SPINDLE DRILLING MACHINE

A heavy multiple-spindle drilling machine designed primarily for producing rivet holes in structural steel members has been added to the line of heavy-duty drilling machines recently developed by the Thomas Spacing Machine Co., Fulton Building, Pittsburgh, Pa. The drill head slides on a heavy vertical column as illustrated, and is driven by a variable-speed motor mounted on top of the head. The motor travels with the head to insure maximum transmission of power with a minimum of moving parts. Directly between the motor and the spindles there is an enclosed chest containing ninety-eight heat-treated and ground gears. Each of these gears is supported on either side by a Hyatt roller bearing. Lubrication is supplied under pressure to all gears in the chest by an oil-pump. Counterweights for the drill head are enclosed within the column.

An Oilgear feed provides flexibility for different drilling operations, affording a rapid traverse in approaching the work or in withdrawing, as well as any desired feed for drilling. The standard roll-over spacing table furnished is power-driven in both directions, and there is a handwheel for making fine adjustments. The table is completely operated through controls grouped directly in front of the operator. Both flanges and the web of structural steel members are drilled in one set-up by employing the roll-over feature of the table, and the spacing feature eliminates the necessity of laying out work.



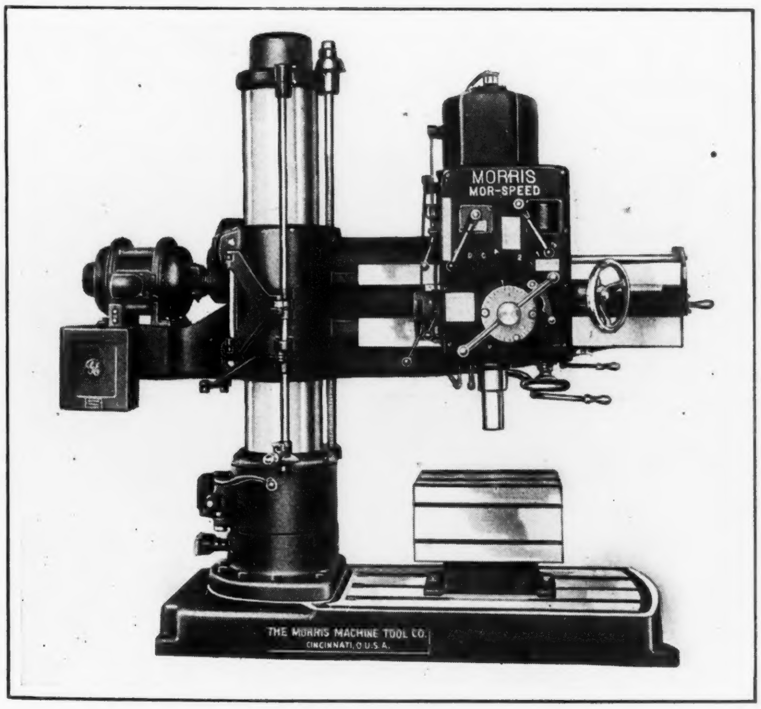
Thomas Multiple-spindle Drilling Machine with Spacing Table

"MOR-SPEED" RADIAL DRILLING MACHINES

Two new sizes of radial drilling machines, with columns 11 and 13 inches in diameter, have been added to the "Mor-Speed" line built by the Morris Machine Tool Co., Court and Harriet Sts., Cincinnati, Ohio. These machines are similar in design to the 9-inch column machine brought out by the concern about two years ago. Only one motor, which is of the constant-speed type and is mounted on the arm, is employed to run the entire machine, including the elevating attachment. The machine is provided throughout with anti-friction bearings.

Twenty-seven speeds and twelve feeds are available, all speed and feed changes being made in the head. Central location of all levers and direct-reading index-plates make it possible for the operator to change the speeds and feeds without leaving the drilling position. The column clamp, elevating lever, and head clamping lever are also within easy reach. The arm is raised, lowered, and clamped by manipulating a single lever. The elevating device is in motion only when the arm is being raised or lowered, and elevating or lowering are accomplished without stopping or slowing down the motor. An electrical head-moving device and column clamp, operated from push-button stations on the head, can be furnished.

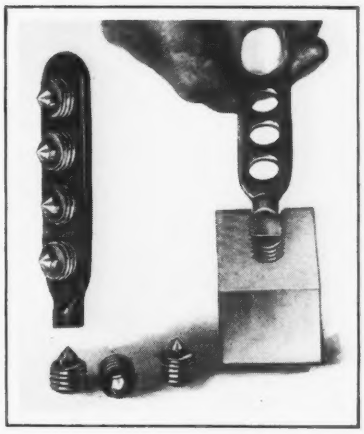
All moving parts of the machine are continuously oiled. The entire head runs in oil, a constant-speed ball-bearing pump delivering oil to the top of the head through a sight-feed oiler. Other parts are lubricated from a central reservoir.



"Mor-Speed" Radial Drilling Machine Now Built in Two Additional Sizes

"MAKE-SHUR" THREADED LOCATING BUTTONS

For locating the holes for screws in a plate or part that is to be secured to a piece in which the threaded holes do not extend all the way through, the National Machine Tool Co., Racine, Wis., has placed on the market sets of four threaded buttons of the design shown in the illustration. By screwing the threaded buttons into the blind holes of a part, allowing the points to project slightly, the positions of the holes can be readily transferred to another part by tapping lightly on the piece holding the buttons.



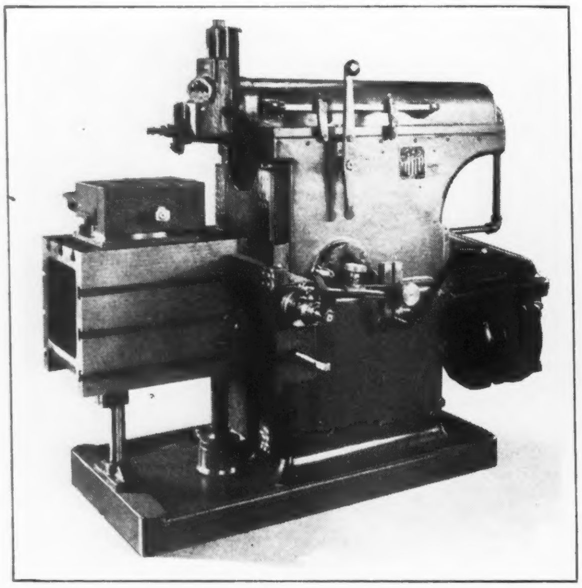
"Make-Shur" Thread Button Set

The punch or point of each button is ground concentric with the threaded portion. With each set of four buttons is included a combination holder and socket wrench. The sets are known as the "Make-Shur," and are manufactured in various sizes.

GENERAL ELECTRIC ENGINE-DRIVEN ARC-WELDER

A portable electric arc-welding machine recently brought out by the General Electric Co., Schenectady, N. Y., is driven by a Buda six-cylinder Model HS-6 gasoline engine. This welder replaces the four-cylinder engine-driven unit previously included in this company's line of welding equipment. The advantages claimed for the six-cylinder engine include ease of starting, steadiness of operation, and greater capacity. The engine develops 39 brake horsepower at 1440 revolutions per minute, and has an average gasoline consumption of 2.4 gallons an hour under ordinary welding conditions at the full rated load.

The generator of this equipment is designated as the WD-300-A and is equipped with ball bearings. A current reducing resistor, in combination with the control furnished by the brush-shifting handle, permits any current to be obtained between 25 and 400 amperes. A 500-ampere ammeter and a 120-volt voltmeter are mounted on the gen-



Hydraulic Shaper Built by the American Broach & Machine Co.

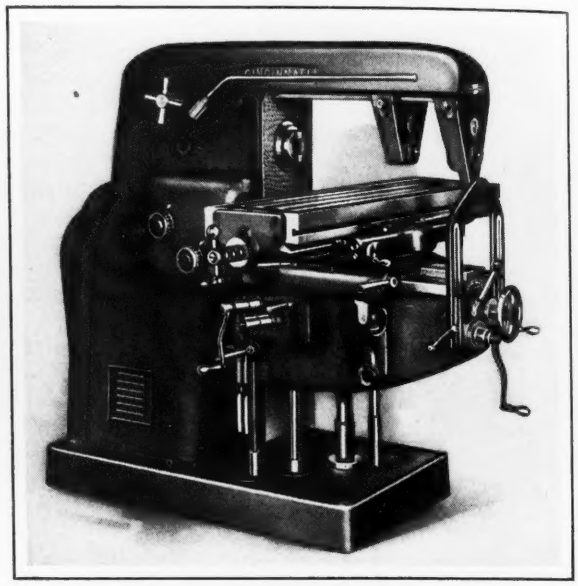


Fig. 1. Cincinnati New No. 3 Universal Milling Machine

erator panel. A self-adjusting stabilizing reactor automatically steadies the arc. The outfit is mounted on a welded structural steel base, and can be made portable by adding running gear.

HYDRAULICALLY OPERATED SHAPER

The 18-inch hydraulic shaper shown in the illustration has recently been placed on the market by the American Broach & Machine Co., Ann Arbor, Mich. A powerful cutting stroke with variable speed control are features claimed for this machine. Provision is made for quickly stopping or cutting off the stroke at any point by manipulating a conveniently located lever, and when this is done, the tool is returned to the starting point.

Speeds range from 0 to 20 strokes per minute on an 18-inch stroke setting, up to 60 strokes per minute on a 6-inch stroke. The pressure developed by the ram, which may be as high as 3 1/2 tons, is applied directly back of the cutting tool. It is recommended that a five-horsepower motor running at a speed of 1200 revolutions per minute be used for driving the machine.

CINCINNATI PLAIN, UNIVERSAL AND VERTICAL MILLING MACHINES

An automatic power shift is provided on the new No. 3 milling machine introduced to the trade at the Cleveland show of the National Machine Tool Builders' Association by the Cincinnati Milling Machine Co., Cincinnati, Ohio, for changing the spindle speeds and table feeds. This power shift is controllable from either the front or rear of the machine. Other features include an independent directional control of power feeds; a power quick traverse in all directions; hand-adjusting cranks at the rear as well as the front of the machine for making vertical and cross adjustments; and the absence of universal joints. This machine is built in plain, universal, and vertical types.

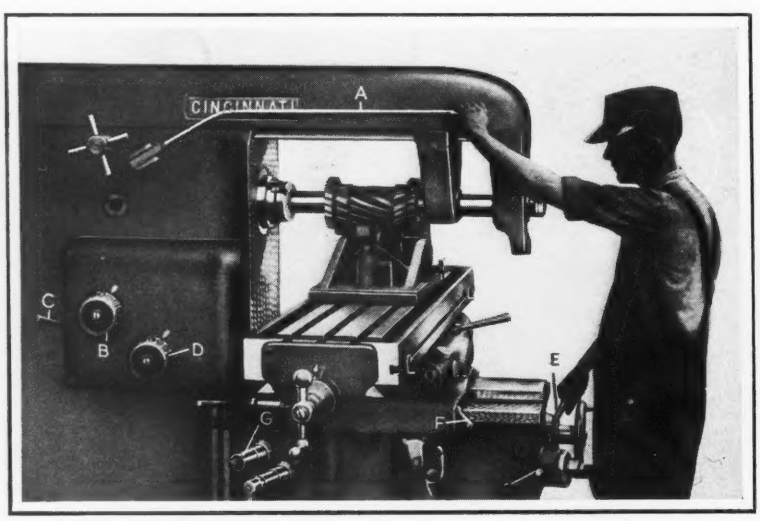


Fig. 2. Changing the Spindle Speed from the Front of the Machine by Power

In changing spindle speeds, the operator disengages the starting lever and throws the speed- and feed-control lever *E*, Fig. 2 (or lever *C*, if he is working from the rear of the machine), to the point marked "Speed." Speed dial *B* rotates while the lever is in this position. The various speeds available are

marked on the colored dial *B*, and when the desired speed appears opposite the arrow, the operator releases control lever *E*, pushes starting lever *A* away from the column, brings it back, and then pushes it upward. Fig. 2 illustrates the manner of changing speeds from the front of the machine, while Fig. 3 shows how the feeds are changed from the rear.

To change the feed, the operator throws the speed- and feed-control lever *E* (or lever *C*, if working from the rear of the machine) to the "Feed" position, and holds it there until the desired feed on the colored dial *D* registers with the arrow, after which it is released. Sixteen speeds ranging from 14 to 450 revolutions per minute are marked on dial *B*, and sixteen feeds appear on dial *D*. Three different series of feeds are available as follows: Low series, 1/4 to 10 inches; standard series, 1/2 to 20 inches; and high series, 3/4 to 30 inches per minute.

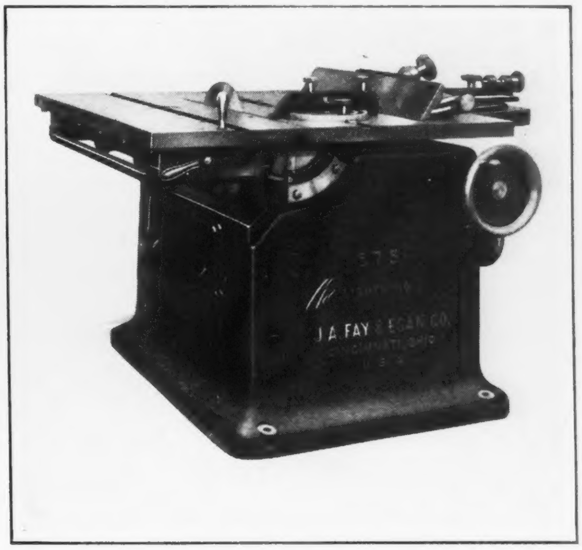
The independent directional control of power feeds is also provided both at the front and rear of the machine. The power rapid traverse is available with the spindle stationary or running, and is controllable from either the front or rear. The quick traverse rates are 100 inches per minute longitudinally, 50 inches per minute crosswise, and 50 inches per minute vertically. It is necessary for the operator to hold lever *F* in position when the power quick traverse is being used, and as soon as he releases this lever, the feed is engaged. The rapid traverse for the table of the plain machine can be automatically disengaged by dogs mounted on the side of the table. Large micrometer dials are supplied for accurately obtaining the desired hand-feed with the front or rear hand-adjusting cranks.

Careful attention has been paid to the lubrication of each unit. The mechanism within the column, including the spindle drive, runs in a bath of oil supplied by a geared pump. Another pump, located in the knee, automatically lubricates the knee, while the saddle and table are lubricated by a one-shot oil system at the left-hand end of the saddle. Anti-friction bearings are used throughout the spindle drive, the spindle being provided with a double mounting of anti-friction bearings both at the front and rear, as well as a floating rear bearing.

The rectangular over-arm has been increased in size, and the two arbor supports are made of aluminum, automatic lubrication being provided for the bearing collars. The supports are 50 per cent lighter than on previous machines of the same size. There are no universal joints on these machines.

The table of all three types of machines has a working surface and over-all size of 62 1/2 by 15 inches. The longitudinal feed is 34 inches, while the cross-feed is 12 inches on the plain and universal types and 16 inches on the vertical machine. The vertical feed is 20 inches on the plain machine, and 19 and 12 inches, respectively, on the universal and vertical machines. A 7 1/2-horsepower motor running at 1750 revolutions per minute is recommended for driving all these machines. The plain machine weighs 6900 pounds, the universal 7200 pounds, and the vertical 7400 pounds.

Fig. 3. How Feeds are Changed from the Rear through the Automatic Power Shift



Fay & Egan Machine with Two Saws for Ripping or Cross-cutting

FAY & EGAN DOUBLE-ARBOR UNIVERSAL SAW

Two saws, driven by separate motors, are provided on a universal saw recently developed by the J. A. Fay & Egan Co., Oakley, Cincinnati, Ohio. These saws are both carried in a frame that revolves on a horizontal axis, so that either saw can be instantly swung upward into the operating position for successively taking rip and cross cuts, etc. Saws 14 or 16 inches in diam-

eter can be carried at the same time. One 20-inch saw can be used, but in that case, the frame cannot be swiveled.

The table is made in two sections, the front half traveling on rollers, which permits cutting off work up to 35 inches wide. The entire table can be swiveled up to 45 degrees for cutting miters. It is self-locking in any position. By opening the table, 2-inch heads may be used for grooving, gaining, and similar operations. Motors of five horsepower rating are furnished for driving the saw arbors. Both motors are interlocked, so that when one saw is in the operating position and its motor is started, the motor for the other saw is automatically stopped. One push-button station is used to control the two motors.

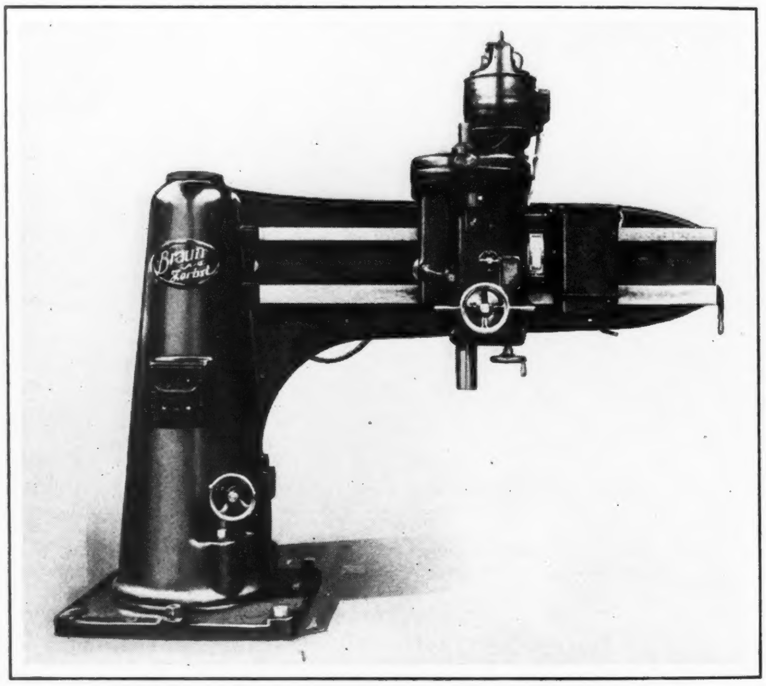
BRAUN HEAVY-DUTY RADIAL DRILLING MACHINES

Radial drilling machines driven by a vertical motor mounted directly on the head are being placed on the American market by the United Machine Tool Corporation, 75 West St., New York City. The main advantage claimed for this construction is a short transmission of power with a minimum of parts. These Braun machines, of the construction illustrated, are built in two models and in eight arm lengths. Practically every bearing in the gear-box, which is placed between the motor and the drill spindle, is of the ball-bearing type.

To insure easy swiveling of the arm for any position of the drill head, a column of double construction is employed. There is an outer column, which revolves, at the top, on radial and thrust ball bearings around an inner column. At the lower end, the outer column runs either on rollers held in a cage or on two rollers which run on ball bearings. The arm and outer column are made in one piece to take care of side thrusts produced by the feeding pressure and the overhanging drill head and arm.

The drill head is made in two sizes. It is traversed along the arm by means of a handwheel located on the same shaft as a double-ended lever which controls the quick vertical adjustment of the spindle. Thus the two most important controls are located one behind the other. Adjustable rollers running on ball bearings insure easy movement and quick adjustment of the drill. Axial pressure on the drill spindle in both directions is taken up by ball thrust bearings. The spindle is fitted with Nos. 4 and 5 Morse tapers, respectively, on the ERB-40 and ERB-70 models. The vertical traverse is 12 and 15 3/4 inches, respectively.

Two manual feeds and one power feed are available. The spindle is driven through spur gears by the vertical motor. With the constant-speed motor normally furnished, only one speed is available. If the speed of the spindle must be varied, this can be done electrically by using a direct-current variable-speed motor or an alternating-current pole changing motor. The machine can also be equipped with three- or four-speed gear-boxes and back-gears. Without the electrical equipment, the machines of this line range in weight from about 4500 to 11,000 pounds.



Braun Radial Drilling Machine Driven by Vertical Motor on Drill Head

GLEASON STRAIGHT-BEVEL GEAR CUTTING MACHINES

Four straight-bevel gears are cut simultaneously in a four-spindle manufacturing type machine recently developed by the Gleason Works, 1000 University Ave., Rochester, N. Y. This machine, which is illustrated in Figs. 1 and 2, was designed primarily for rough-cutting gears of the sizes ordinarily used in automobile differentials. It is completely automatic in operation, including loading and unloading, and one operator can easily handle several machines.

With the exception of the cutter drive, the entire machine is operated hydraulically. The four gear blanks are mounted on independent work-heads arranged around the cutting tool. The latter is a disk milling cutter, 20.8 inches in diameter, and has thirty-two inserted blades. It can be seen in Fig. 2. Each work-head can be adjusted to set the work to the proper root angle and cone distance.

In operation, each work-head is fed toward the cutter to cut a tooth slot in the blank, and is then withdrawn for indexing. After all the teeth are cut, the work-head recedes approximately 5 inches to the loading position, the cut gear is automatically pushed off the arbor, and a new blank is taken from the magazine by an automatic loading mechanism, placed on the arbor, and clamped. The work-head then returns to the operating position, after which the cutting and indexing cycle is begun again on the new gear blank.

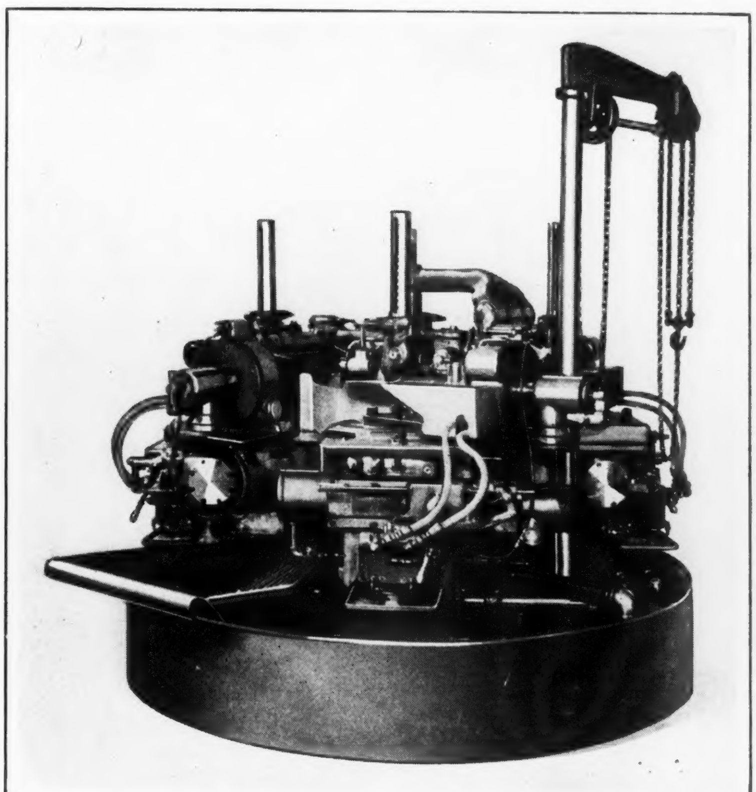


Fig. 1. Gleason Automatic Gear-tooth Roughing Machine which Cuts Four Blanks Simultaneously

The operator only needs to keep the four magazines supplied with blanks. A safety control prevents the feed movement from starting in case a blank is not properly placed on the arbor. The completed gears, together with the oil and chips, slide down a chute into a pan, where they are separated.

The indexing mechanism is of the notched plate type, and it is only necessary to change index-plates in order to cut gears of different numbers of teeth. The travel of each work-head is controlled by a stop dog, and the speed of this movement is governed by a cam, which controls the main work-slide valve.

The time taken by the work-head in moving to the loading position is governed by an adjustable control device which can be set for gears having any number of teeth up to thirty. When the work-head slide withdraws from the cutter after cutting each tooth, this control device indexes one notch, and when the last tooth is finished, the device trips a dog, which permits the main piston to recede to its extreme position for loading. The control device then automatically resets itself. The various operations cannot get out of time with each other, as they are controlled by a series of valves cut in a single drum.

In many cases, several different gears or pinions may be roughed simultaneously with the same cutter. Placement and removal of the cutter is facilitated by a crane and chain hoist, a supporting bracket being bolted to the central column for the crane standard and cutting-oil feed-pipe. Four supply pipes convey coolant to the cutter at the cutting positions, the coolant being delivered by a centrifugal pump having a capacity of forty-five gallons per minute. Lubrication of the cutter and drive spindles and of the bearings of the machine is effected by two pumps that are cam-operated from the main drive piston.

Some of the important specifications of this machine are as follows: Largest diametral pitch that can be cut, 3; maximum pitch diameter that can be cut, 4 inches; minimum and maximum number of teeth that can be cut, 6 and 30, respectively; speed of cutter-head, from 115 to 520 feet per minute; and weight of machine, approximately 12,000 pounds.

The Gleason Works has also recently brought out the 3-inch straight-bevel gear generator illustrated in Fig. 3 which handles gears up to 4 1/2 inches pitch diameter, 2 1/4 inches cone distance, and 10 diametral pitch. The machine is designed for either large or small production, and will both rough and finish in either one or two operations, depending upon the pitch and quality of work desired.

The gears are finished by the same generating principle as embodied in previous straight-bevel gear generators made by the concern. The tooth shape is developed by rolling the teeth between reciprocating tools which represent adjacent sides of a tooth in an imaginary crown gear. One of the improvements embodied in this machine is a quick throw-out mechanism which enables the operator to move the tool-head into or away from the cutting position by a single movement of a lever. This provides plenty of room for chucking or removing the gears.

The work-head is mounted on a cradle on which it is adjustable angularly and in the direction of the work-spindle to permit setting the work to the proper cut-

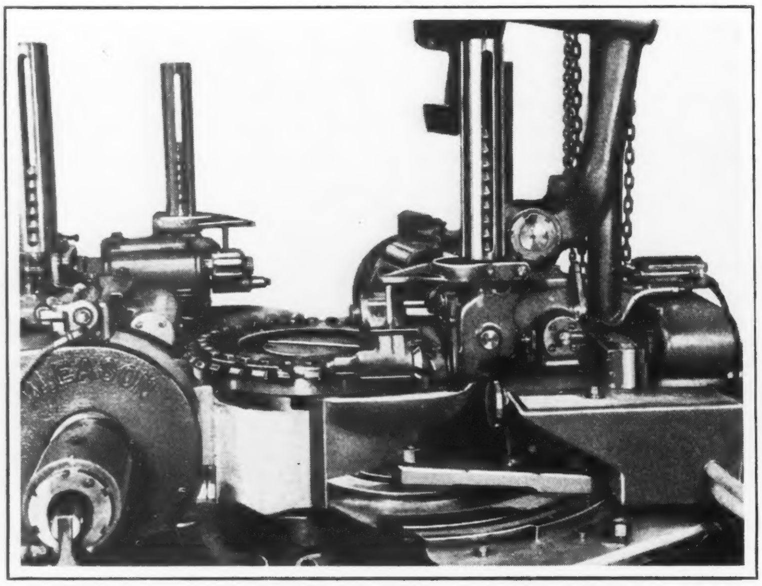


Fig. 2. View of the Disk Milling Cutter which Cuts Four Blanks at a Time on the Gleason Gear-cutting Machine

ting angle and cone distance. The work segments are adjustable, so that each segment covers a range in pitch angles from about 1 degree on the small pinion segment to 7 degrees on the largest gear segments. Thirty-two segments cover the entire range of the machine. The tools used on this generator are identical to those used on the larger machine, except for size.

This machine is furnished with a built-in motor drive only, a 1/2-horsepower motor driving the tools, and a 1/4-horsepower motor the rest of the machine. Some of the principal specifications are as follows: Maximum and minimum pitch angle with shafts at 90 degrees, 75 degrees 58 minutes, and 14 degrees 2 minutes, respectively; extreme ratio of gears, 4 to 1; range of tool strokes, from 200 to 800 per minute; and weight of machine, 1500 pounds. The feeds available permit a cutting time of 1 1/2 to 30 seconds per tooth.

VERTICAL CHUCKING MACHINE

Adaptability for a wide range of work, high production rates, minimum floor space requirements, rigid construction, and

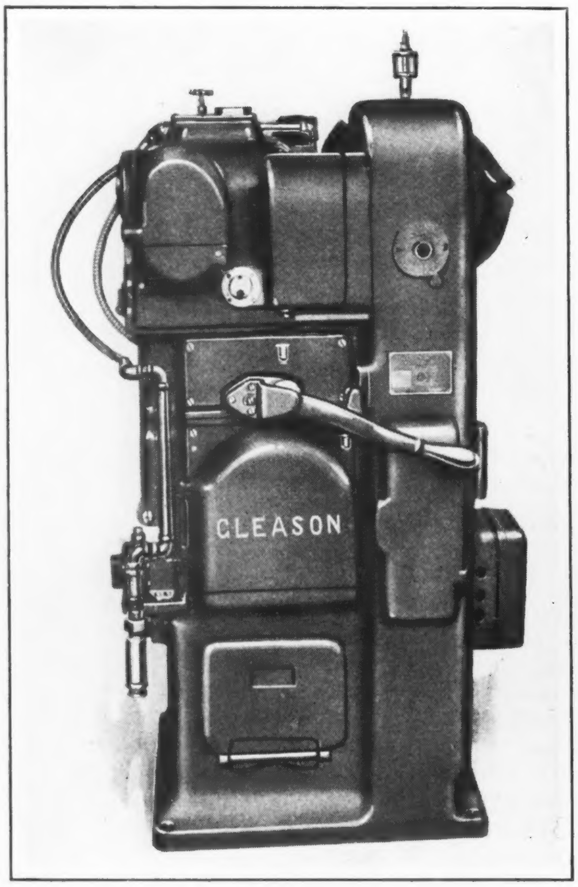
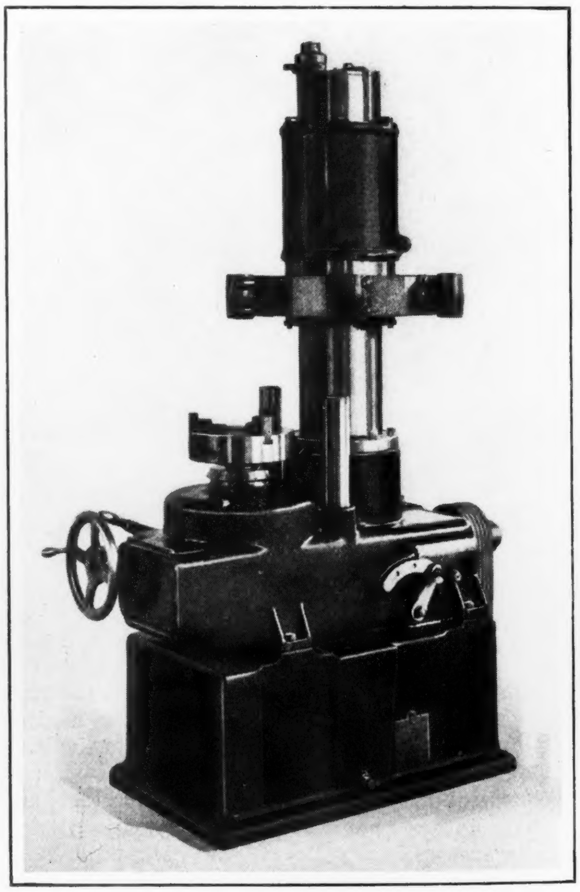


Fig. 3. Gleason Straight-bevel Gear Generator for Gears up to 4 1/2 Inches Pitch Diameter



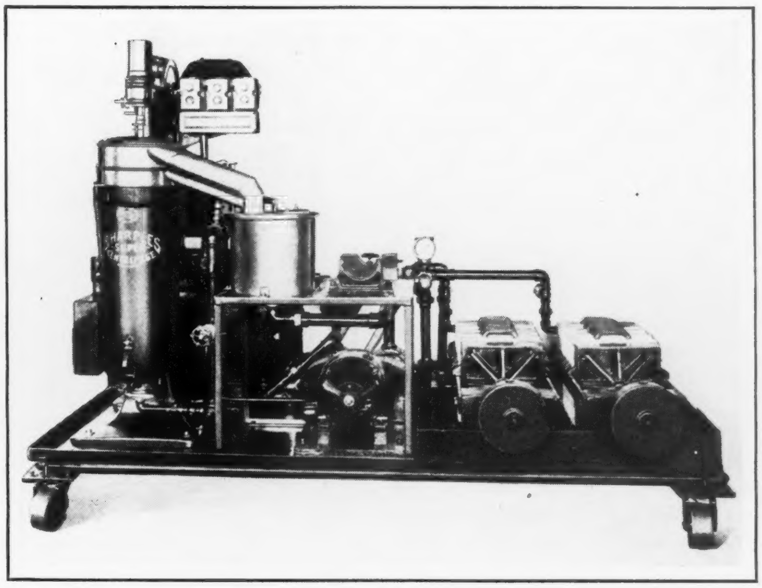
Vertical Chucking Machine with Tool Turret which Indexes and Feeds Automatically

ease of operation are among the advantages claimed for a vertical chucking machine recently placed on the market by the Production Machinery Sales Co., Inc., 4845 St. Aubin Ave., Detroit, Mich. The vertical spindle on which the chuck of this machine is mounted receives the end thrust imparted by the cutting tools, in a downward direction. This feature tends to eliminate end play, and keeps the work accurately positioned. The six-face hexagon turret which holds the tools feeds and indexes automatically. The cross-slide (not shown in the illustration) is designed to be mounted on the vertical standards shown at each side somewhat to the rear of the chuck. Operation of this slide is accomplished either by a hand-feed screw or automatically by means of a cam mounted on the turret.

The machine is equipped throughout with Timken roller bearings. A motor mounted in the base operates the machine through a "Cog-Belt" drive. The control is through a lever-operated clutch and brake, which enables the chuck to be started and stopped instantly.

Each of the six turret faces can be used to hold a tool. In addition, provision is made for securing a tool to the under side of the turret in each of the six positions. The automatic indexing mechanism can be adjusted to index the turret at any desired height. Three spindle speeds are available by operating a lever, and additional speeds may be obtained by means of pick-off gears in the front gear-box.

Down feed of the turret is furnished by a gear-box in the base of the machine. Feeds independent of the spindle speeds, ranging from 0.005 to 0.040 inch per revolution of the work, are available. If desired, hydraulic feed can be provided. Although the machine occupies a floor space of only 26 by 42 inches, it has a capacity for swinging work up to 16 inches in diameter and performing drilling or boring operations to a depth of 9 inches or more. One man can run more than one machine.



Sharples Portable Equipment which Cleans 1200 Gallons of Oil per Hour

SHARPLES CENTRIFUGE AND OIL PURIFIER

A portable combination centrifuge and filter press capable of cleaning 1200 gallons of oil per hour is being placed on the market by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. This equipment is made by the Sharples Specialty Co., and consists of a Sharples super-centrifuge combined with Westinghouse filter press equipment.

The complete outfit is mounted on a truck, forming what is claimed to be the largest portable equipment of its kind on the market. A floor space of 54 by 106 inches is required.

BOYE & EMMES "CONELESS" LATHES

Fourteen- and sixteen-inch lathes recently brought out by the Boye & Emmes Machine Tool Co., 2245-51 Spring Grove Ave., Cincinnati, Ohio, are equipped with geared or "coneless" head-

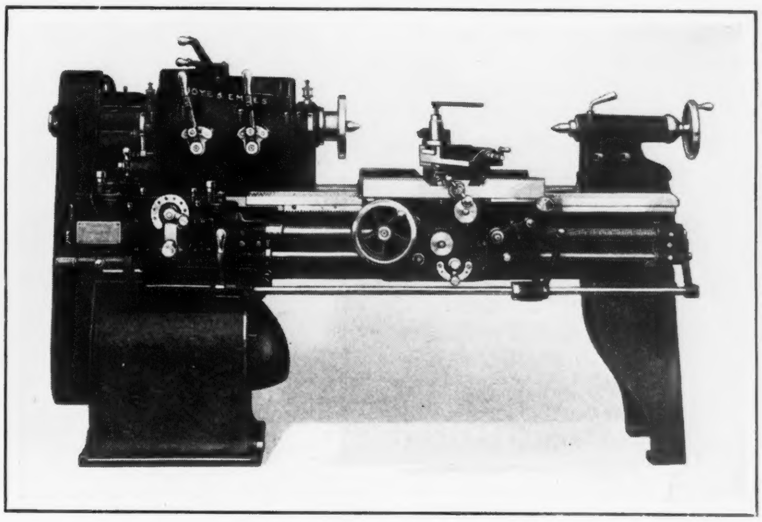


Fig. 1. Boye & Emmes "Coneless" Engine Lathe Built in 14- and 16-inch Sizes

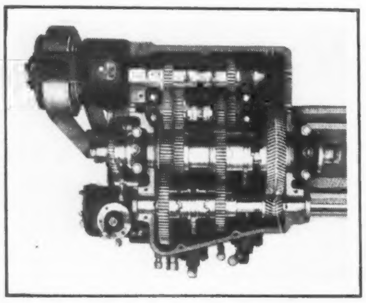


Fig. 2. Arrangement of the Headstock Gears on the Boye & Emmes Lathe

stocks in which all gears are constantly in mesh. Any one of twelve spindle speeds can be obtained while the machine is running by moving levers to shift clutches, without danger of interference between gears of conflicting ratios. Timken bearings, which can be adjusted at the ends of the headstock without removing the headstock cover, are regularly provided for all shafts, with the exception of the main spindle, which is ordinarily equipped with lapped bronze bearings. If desired, however, the spindle also can be furnished with anti-friction bearings. The clutches, by means of which the changes in speed are obtained, slide on shafts having multiple splines milled from the solid metal. The driving pulley with its multiple disk clutch is supported at each side by bearings.

A feature of the headstock is the arrangement of the gears, which is shown in Fig. 2. Those giving the eight lowest spindle speeds, which are employed for taking heavy cuts, are mounted in front of the spindle. Thus, the spindle is given a downward pressure on the headstock instead of an upward pressure on the bearing caps. This arrangement also counteracts the upward lift of the tool.

The quick-change gear-box furnishes forty changes of thread leads or feeds. Changes from one feed to another can be made instantly without any binding action on the levers. By changing two gears on the quadrant, odd or metric threads can be cut.

One oil reservoir serves to lubricate the entire apron. An interlocking arrangement in the apron prevents the engagement of conflicting feeds. The carriage is of heavy construction and slides on two V-ways. It is drilled and tapped to receive a follow-rest and a taper attachment.

The motor is mounted in a cabinet which forms the leg at the headstock end of the lathe. Either a flat or multiple V-belt or a silent chain drive can be furnished. The lathe can also be equipped for a single pulley drive from a line or countershaft.

The swing over the bed of the 14-inch lathe is 16 1/2 inches, and over the 16-inch lathe, 18 1/2 inches. The range of spindle speeds is from 15 to 402 revolutions per minute. The feeds per revolution of the feed-rod range from 0.004 to 0.112 inch, and from 2 to 56 threads per inch can be cut. The 14-inch lathe weighs 2850 pounds, and the 16-inch lathe, 3000 pounds.

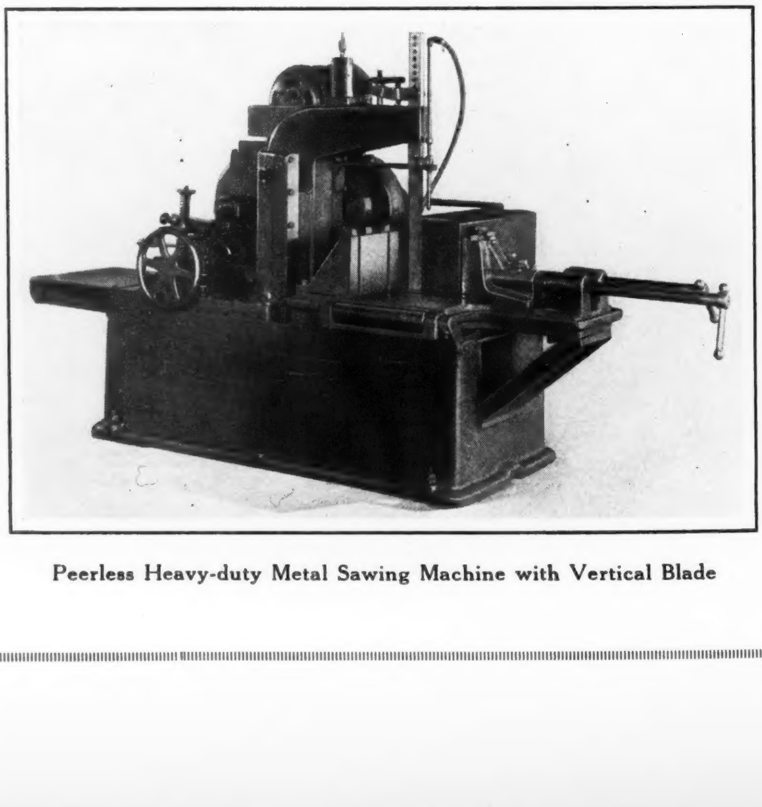
PEERLESS VERTICAL-BLADE METAL SAWING MACHINE

A vertically reciprocating saw blade is employed in a 14- by 16-inch heavy-duty metal sawing machine shown at the National Machine Tool Builders' Exposition by the Peerless Machine Co., 1218 Sixteenth St., Racine, Wis. This machine is intended for cutting large bars and billets. The work can be conveniently placed on the machine table by an electric crane or other means, due to the fact that the blade operates up and down while being forced into the work instead of moving across the top of the work in the conventional manner.

The vertical position of the blade also enables a heavy stream of cooling solution to be applied at the top of the cut, which greatly assists in forcing out the chips at the bottom of the cut. The blade automatically relieves itself on the non-cutting stroke. At the conclusion of a cut, the machine automatically trips out, and the frame that carries the saw blade returns to its original position where it stops.

There is a roller arrangement built into each side of the work-table which can be raised to lift the work and facilitate moving it into position for the cut. When the device is lowered, the work is held solidly in place on the table for the operation. Each of the front vise jaws is provided with hardened serrated surfaces to guard against the stock moving. The construction of the machine is heavy and rigid, the weight being approximately 4500 pounds.

The arrangement by which the blade is fed into the work includes both a positive and compensating feed. A safety feature prevents the blade from



Peerless Heavy-duty Metal Sawing Machine with Vertical Blade

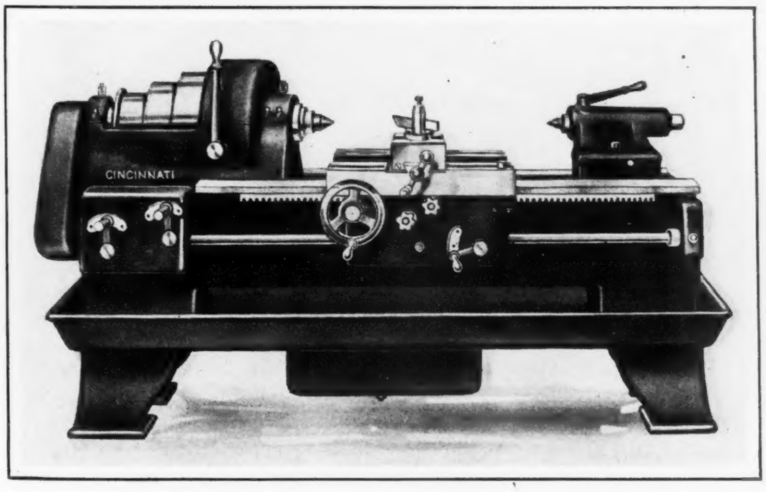
breaking when it becomes dull. The machine is equipped throughout with ball bearings, and the transmission runs entirely in oil. An instruction plate fastened to the machine indicates the proper feed pressure to be used for various kinds and diameters of work. Three operating speeds are provided, the machine being motor-driven through a chain. Saw blades from 17 to 24 inches in length can be employed on this machine.

CINCINNATI "MAXI-PRODUCTION" LATHES

Speeds of 1000 revolutions per minute and more to permit the best results with the new tungsten-carbide tools are obtainable on a line of lathes recently brought out by the Cincinnati Lathe & Tool Co., 3207-11 Disney St., Oakley, Cincinnati, Ohio. These lathes are built with swings up to 17, 19, and 21 inches, respectively, and in various lengths from 6 feet upward. The construction can be seen in the illustration.

By operating the lever on the headstock, the spindle is started and stopped immediately through a positive friction clutch and brake, but the cone continues operating until stopped by the two-speed, self-oiling countershaft. The lathes are furnished with or without back-gears. The spindle has a 2 3/8-inch hole through its entire length and is mounted in Timken roller bearings.

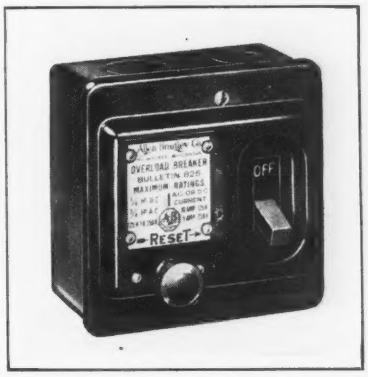
The tailstock is constructed to permit a wide range of adjustments at different angles relative to the compound rest. Either a quick-acting tailstock or one with the standard screw-feed arrangement can be supplied. The feed-box gives a large range from very coarse to the finest feeds. It may be replaced any time with a quick-change gear device for screw cutting. A plain rest is provided with the regular equipment, but any of the standard rests or turret attachments made by the company can be supplied.



Cincinnati Lathe which Runs at Spindle Speeds of 1000 Revolutions per Minute and Greater

ALLEN-BRADLEY OVERLOAD BREAKERS AND MOTOR STARTERS

A complete line of overload breakers for fractional-horsepower direct- and alternating-current, single-phase and polyphase motors has recently been placed on the market by the Allen-Bradley Co., 499 Clinton St., Milwaukee, Wis. These devices, known as Bulletin 825 overload breakers, afford protection against motor burnouts and damage to equipment due to overloads. The breakers have a maximum rating of 1 horsepower at 125 volts and 1 1/2 horsepower at 220 volts. They may be obtained with or without snap switch or fuse clips. Six different forms are manufactured to suit a large variety of industrial applications.

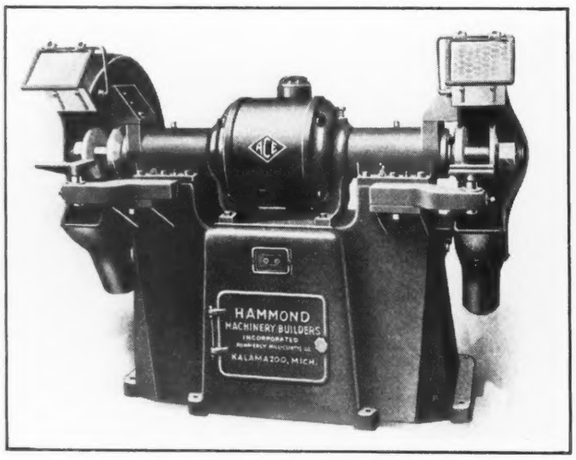


Allen-Bradley Overload Breaker for Preventing Damage to Small Motors

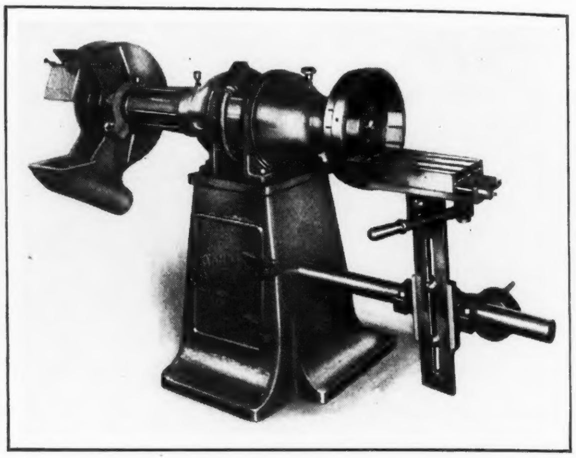
The standard alternating-current "across-the-line" switches made by the same concern are now furnished with hand-operated disconnect switches and meter test jacks enclosed in one cabinet. The disconnect switches are furnished with or without fuse clips. The meter test jacks permit the motor to be tested for load without opening the switch cabinet or interfering with the machine operation. Bulletin 711-712 switches provide overload, dead-phase, and no-voltage protection. The switches are rated up to 10 horsepower at 110 volts; 30 horsepower at 220 volts; and 60 horsepower at 440 to 550 volts, and are furnished in three forms: Form 1 has push-buttons in the cover; Form 2 has a pilot control; and Form 3 is equipped with a three-way lever switch.

"ACE" HEAVY-DUTY ELECTRIC GRINDERS

Type WH "Ace" heavy-duty electric grinders recently placed on the market by Hammond Machinery Builders, Inc., Kalamazoo, Mich., are made in 5, 7 1/2, and 10 horsepower sizes. They are driven by totally enclosed motors fitted with patented air cleaners, and can be furnished for direct or alternating currents of various voltages. The air cleaners remove dust and dirt from the air before it enters the motor windings. The automatic motor starter has thermal over-



"Ace" Heavy-duty Electric Grinder Made by Hammond Machinery Builders, Inc.



Combination Grinder Manufactured by the Standard Electrical Tool Co.

load and low-voltage protection, a push-button control being conveniently mounted on the pedestal.

Four ball bearings are provided for the chrome-manganese steel spindle. The ball bearings are completely enclosed and protected from dust and grit by seals. Timken tapered roller bearings can be supplied to order. The adjustable wheel guards with hinged doors, exhaust pipe connection, adjustable spark and chip breaker, and eye shield are all provided as standard equipment.

HACKSAW FRAME AND BROKEN-BLADE ATTACHMENT

A hacksaw known as the "Champion No. 125," which can be adjusted to take any length of blade, has recently been placed on the market by the Forsberg Mfg. Co., of Bridgeport, Conn. When equipped with the No. 150 broken-blade attachment, which is another recently developed product of this company, broken blades can also be used in this tool. Although designed for this particular saw, the broken-blade attachment can be used on any hacksaw frame. The attachment can be used at either end of the frame, and is particularly useful in salvaging new saw blades which frequently break near the end from the high tension that is applied.

STANDARD ELECTRICAL COMBINATION GRINDER

A combination grinder having a ring wheel chuck on one end of the spindle and an emery wheel on the other has recently been placed on the market by the Standard Electrical Tool Co., 1938-46 W. 8th St., Cincinnati, Ohio. This machine is made in 2, 3, 5, and 7 1/2 horsepower sizes, and is equipped with SKF ball bearings. A ball thrust bearing is also used to take the end thrust of the ring wheel chuck. The machine shown in the accompanying illustration is of the five-horsepower size, and is equipped with a General Electric motor.

WESTINGHOUSE DUAL-DRIVE WELDING UNIT

An arc-welding unit driven by either a gasoline engine or an electric motor has recently been brought out by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. This dual-drive unit consists of a standard 300-ampere single-operator welding generator, a 15-horsepower alternating-current induction motor and a six-cylinder Continental gasoline engine running at 1800 revolutions per minute. All of these are mounted on a structural-steel welded base.

The motor operates on 220-volt current, but by merely reconnecting the external motor leads and changing the line-starter coil it can be used on 440 volts. Either the gasoline engine or the electric motor can be used for driving the generator by simply engaging or disengaging the slip coupling or clutch, which ever is provided. Where electric current is available, the motor is used, and in isolated places, the gasoline engine is employed. Dual-drive welding outfits can be furnished in all single-operator ratings and in stationary or portable models.

FREW AUTOMATIC TAPPING MACHINE

On the automatic tapping machine shown in the illustration, the operator simply sets a stop on the spindle for the depth to which he desires to tap and pulls down the operating handle. This causes the tap automatically to enter the work, reverse at the predetermined point, and return quickly to the starting position. The Frew Machine Co., 132 W. Venango St., Philadelphia, Pa., recently placed this machine on the market. Embodied in its design are the principal features of the No. 1 machine described in May, 1926, MACHINERY, page 756. However, the No. 2 machine is designed for heavier work, the rated capacity being for from 1/2- to 1 1/4-inch U. S. standard taps.

The head is equipped with Timken roller bearings, and the weight of the table is carried on a ball thrust bearing. Several types of drives can be provided. The belt drive consists of a unit provided with a two-step cone which is bolted to the back of the column. This gives two speeds to the tapping spindle. For a greater range of speed, a four-speed gear-box is used which operates in much the same manner as an automobile transmission. This gear-box is equipped throughout with Timken roller bearings.

When a motor drive is used, a three-horsepower motor running at a speed of 1200 revolutions per minute is mounted on the base, as shown. The drive from the motor to the clutch may be through a chain or flat or V-belts. The spindle speeds available depend upon the size of the pulleys used with the gear-box. When a motor running at a speed of 1200 revolutions per minute and a 4 1/2-inch diameter pulley are used, four spindle speeds of 81, 106, 137, and 177 revolutions per minute can be obtained.

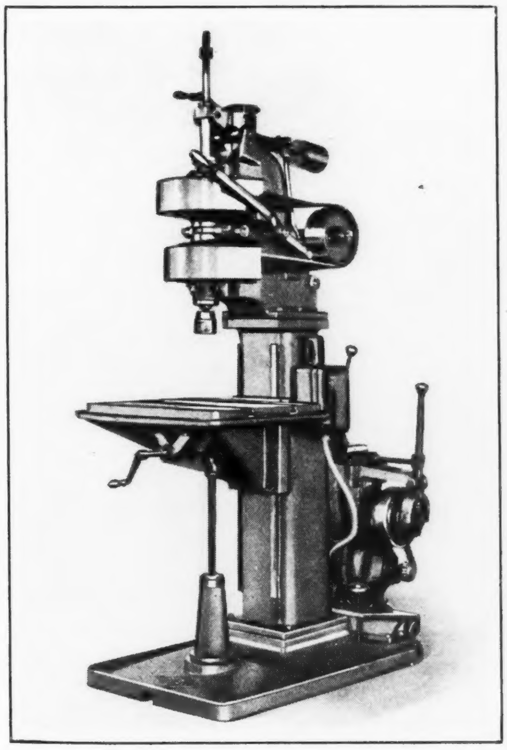
The maximum depth that can be tapped with this machine is 3 inches. The table measures 24 by 20 inches, and the maximum distance from the chuck to the top of the table is 18 inches. The distance from the table to the column face is 10 1/4 inches.

EDLUND PRODUCTION DRILLING MACHINE

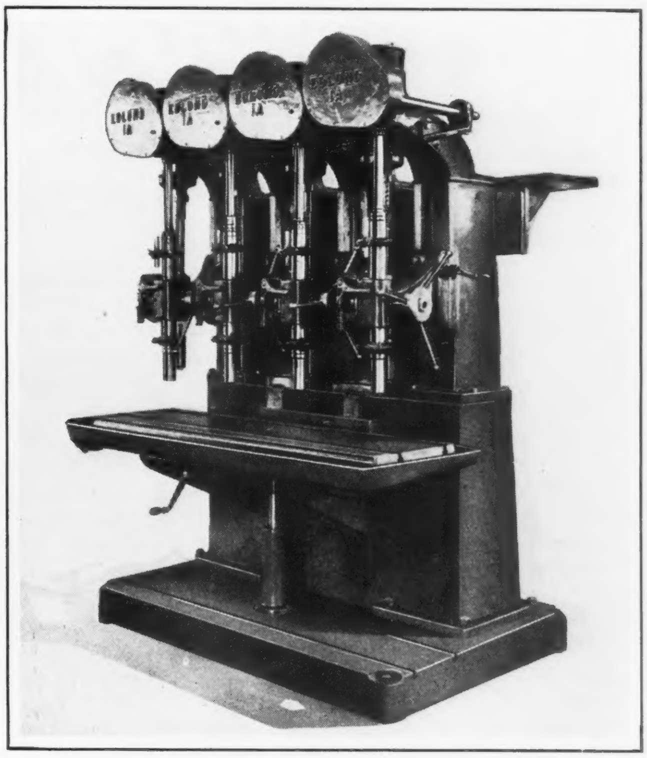
A No. 1A 24-inch production drilling machine recently placed on the market by the Edlund Machinery Co., Inc., Cortland, N. Y., is built with any number of spindles up to four and may be provided with riser blocks if required. Separate motors are employed for driving the different spindles. Each motor is mounted on an adjustable bracket which permits different motors to be used without employing shims to obtain proper alignment. This is an advantage when a motor must be replaced temporarily while undergoing repairs or when a change in motors is desirable. Flexible couplings between the motors and drive shafts take care of any slight misalignment.

The hardened steel change-gears on this machine are fitted to their shafts with two broached keys, thus avoiding the use of separate keys. Each drive consists of a spiral-bevel pinion in mesh with a gear mounted on a "four - spline" broached sleeve which, in turn, transmits motion to the spindle.

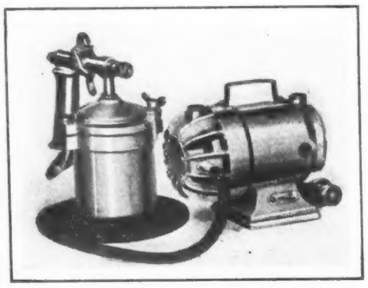
The machine can be furnished with either hand or power feeds, as desired. The power feeds are driven by change-gears which give feeds ranging from 0.006 to 0.028 inch per revolution of the spindles. When multiple drilling heads are employed, additional counterweights can be readily attached to balance the spindles. If a coolant system is required, a bracket carrying an independent motor-driven pump is attached to the side of the machine base. The spindles may have either No. 3 or No. 4 Morse taper sockets. If required, flanged quills may be supplied. The capacity for drilling in steel is 1 1/2 inches.



Automatic Tapping Machine Brought out by the Frew Machine Co.



Edlund Four-spindle Production Drilling Machine with Individual Motor Drives to the Spindles



"Tornado" Portable Paint Spraying Equipment

"TORNADO" PORTABLE PAINT SPRAYER

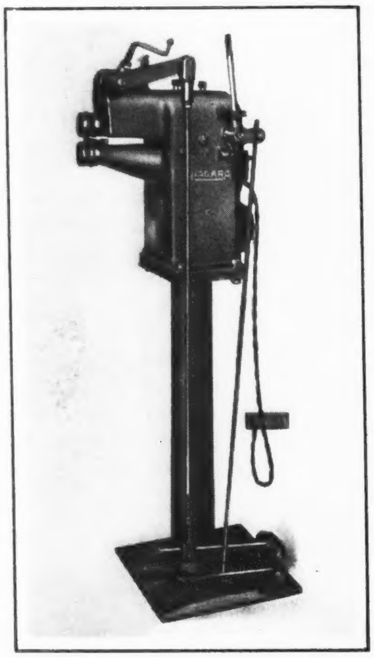
A portable electric paint sprayer known as the "Tornado" has recently been placed on the market by the Breuer Electric Mfg. Co., 852 Blackhawk St., Chicago, Ill. This sprayer is of the compressor type, and is intended for "touch-up" work, shading, light finishing, and refinishing jobs, as well as for semi-production and maintenance work. The device is built of aluminum castings. It is equipped with a 1/3-horsepower General Electric universal motor, and develops a pressure of 35 pounds per square inch. The weight of the compressor unit is 7 pounds.

The spray gun is equipped with two tips, one being slotted to give a fan spray, while the other is designed to give a narrow spray. An adjusting screw controls the amount of paint used. The weight of the spray gun is only 2 pounds.

NIAGARA COMBINATION SHEET-METAL WORKING MACHINE

Operations on sheet metal, such as burring, turning, wiring, crimping, beading, slitting, flanging and elbow-edging, can all be performed on the No. 172 electric combination machine recently placed on the market by the Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y. This machine is operated by a 1/4-horsepower motor connected to an ordinary lighting socket, and will handle sheet metal up to No. 18 gage. The frame of the machine forms a housing for the motor, and encloses all gears and clutch parts. Protection against damage from overloading is provided by a switch mounted on the machine. The drive shaft and the intermediate shafts are mounted in ball bearings, while the roll shafts are provided with bronze bushings.

The motion of the upper shaft is controlled by a combination crank-screw and foot-treadle, either of which operates independently without removing or adjusting the other. Lateral adjustment of the upper shaft is accomplished by two knurled screws. Two treadles provide for convenient operation of the clutch or the upper-shaft motion. Standard rolls for performing the various operations for which the machine is adapted are kept in stock, and rolls for special operations are made to suit specifications.

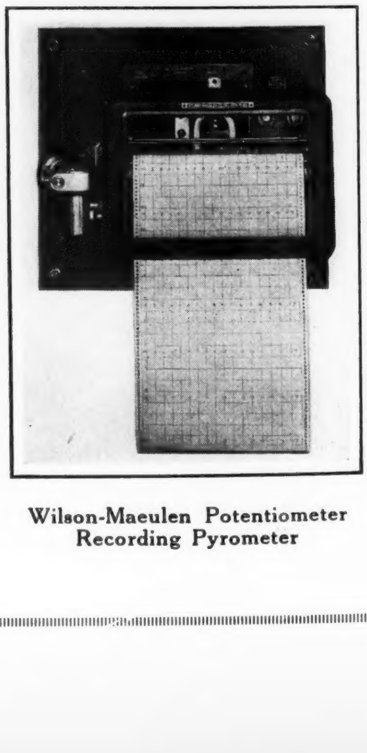


Niagara Combination Sheet-metal Working Machine

WILSON-MAEULEN PYROMETER RECORDER

A potentiometer recording pyrometer recently developed by the Wilson-Maeulen Co., Inc., 383 Concord Ave., New York City, has a temperature record chart 12 inches wide and embodies other new mechanical and electrical features. Three chart speeds, namely, 3/4, 1 1/2, and 3 inches per hour, are available. On operations where temperature changes are slow and long periods of time are involved, the slow speed condenses the record and makes the observation of trends and cycles easier. For rapidly fluctuating temperatures and short cycles of operation, the faster speeds allow a more detailed analysis of temperature changes. The ink developed for this recorder is of a brilliant red color and dries before the chart emerges from the case, so that smearing is obviated. The sprocket at one end of the paper roller is adjustable to compensate for variations in the width of the paper due to atmospheric conditions. Charts are available for a wide selection of scale ranges in both Fahrenheit and Centigrade scales.

Changes in the temperature of the thermo-couple cold junction are automatically compensated for by an electric cold-junction compensator similar to those used on all types of Wilson-Maeulen pyrometers for several years. An external drive unit consisting of a motor and double speed reducing system furnishes power to the instrument mechanism. There is ample power for operating more than one instrument, and so a group of recorders or a group combining



Wilson-Maeulen Potentiometer Recording Pyrometer

this recorder and an automatic temperature control pyrometer can be operated by one drive unit.

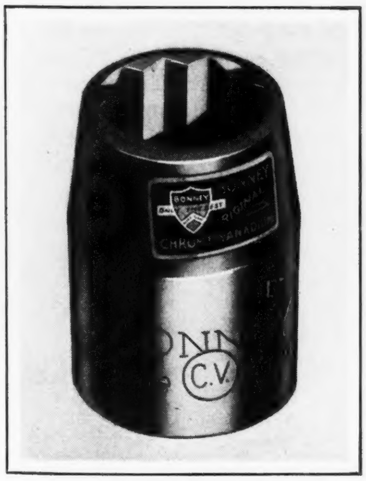
For low temperatures of from 600 degrees F. down to zero or lower, this recorder is supplied to operate as an electric thermometer employing resistance bulbs. The instrument case opens diagonally, making the entire mechanism easily accessible.

BONNEY DOUBLE-HEXAGON WRENCHES

Double-hexagon chrome-vanadium sockets in a complete range of sizes have recently been added to the line of wrench equipment made by the Bonney Forge & Tool Works, Allentown, Pa. As shown in the illustration, this socket has very thin walls, a feature made possible by the strength of the alloy steel used.

Two sets of wrenches have also been recently added to this company's line. One set, known as the No. 29, consists of three short double-hexagon double-end box wrenches in sizes that fit the six most commonly used nuts and bolts.

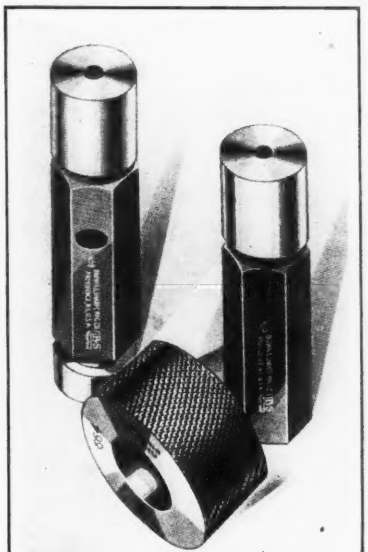
The No. 31 set consists of six double-hexagon double-end box wrenches of the regular length, which fit the twelve most frequently used nuts and bolts. These wrenches make it possible to remove nuts or bolts where the wrench can be given only one-twelfth turn.



Bonney Double-hexagon Wrench Socket

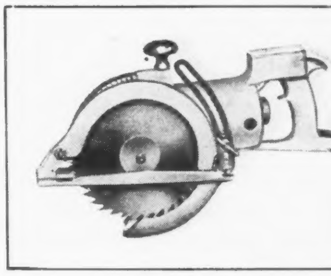
BROWN & SHARPE RING AND PLUG GAGES

A line of plain ring and plug gages, conforming in design to the standards specified by the American Gage Design Committee, has recently been placed on the market by the Brown & Sharpe Mfg. Co., Providence, R. I. The plug gages, known as No. 659, are furnished with either single- or double-end handles, as shown in the illustration. The "Go" gages are easily distinguished from the "Not Go" gages by their longer gaging surfaces. These gages are furnished in any size or combination of sizes from 0.241 to 1.510 inches in diameter. All the handles are of hexagonal shape, and they are finished in black.



Brown & Sharpe Ring and Plug Gages

The ring gages, known as No. 664, are also furnished in "Go" and "Not Go" styles and in any size or combination of sizes from 0.241 to 1.510 inches. The smaller rings, ranging in size from 0.241 to 0.510 inch, are of two-piece construction with hardened, ground, and lapped bushings inserted in "soft" gage bodies. The larger rings are solid. The "Not Go" ring gages are easily distinguished from the "Go" gages by a groove running around the knurled portion.



Wodack Light-weight Hand Saw

WODACK PORTABLE ELECTRIC HAND SAW

A portable electric hand saw known as "Junior Model K," which weighs only 15 pounds, has recently been placed on the market by the Wodack Electric Tool Corporation, 4627-4629 W. Huron St., Chicago, Ill. When fitted with a bakelite-bond grinding wheel about 1/8 inch thick, this tool is effective in cutting light-gage sheet metal. Equipped with a circular saw, boards up to 2 5/8 inches in thickness can be cut.

The 1/2-horsepower General Electric universal motor operates on both direct and alternating current of 110 volts. A conveniently located trigger switch controls the motor. The tool can also be furnished with a 220-volt motor. A blower is incorporated in the tool for removing the sawdust.

NEW DEPARTURE N-D-SEAL BALL BEARINGS

Self-sealed, self-lubricated ball bearings designed with a view to reducing mounting costs and, at the same time, increasing bearing efficiency, have been brought out by the New Departure Mfg. Co., Bristol, Conn. These N-D-Seal bearings are made only in the smaller sizes. Each of them consists of what is essentially a New Departure single-row ball bearing of the non-loading groove type, permanently fitted into a metal case or shell, as shown in Fig. 1. This shell is shaped on one side of the bearing to contain a felt closure which fits over the ground outside diameter of the

extended inner ring, as may be seen in Fig. 2, thus forming a seal both for the retention of lubricant and the exclusion of dirt.

While the inner ring is carried slightly beyond the face of the seal to facilitate removing the bearing without damage and to prevent interference between the shaft shoulder and the seal, the over-all width of the bearings is much less than the space occupied by standard bearings of the same sizes with separate closure members. The outside diameters and bores are of standard dimensions.

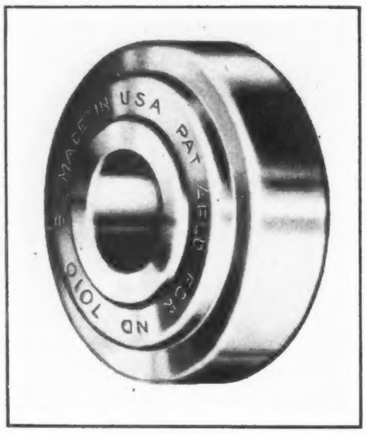


Fig. 1. New Departure "N-D-Seal" Ball Bearing

The N-D-Seal bearings have substantially the same capacities as corresponding sizes of non-loading groove single-row bearings. It is stated that they are capable of resisting a comparatively high amount of thrust in combination with a radial load.

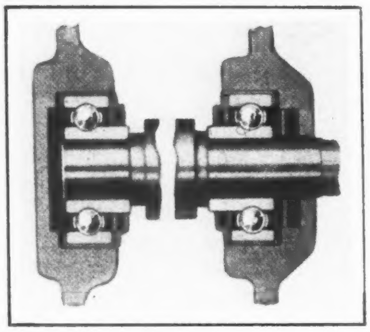


Fig. 2. Typical Mounting of "N-D-Seal" Ball Bearings

MORSE DIEMAKERS' REAMERS

A line of No. 678 reamers, designed especially for the use of diemakers, has recently been placed on the market by the Morse Twist Drill & Machine Co., New Bedford, Mass. The taper on these reamers is equivalent to an included angle of 3/4 degree, or approximately 0.013 inch per inch. This angle or taper provides the clearance required for die work.

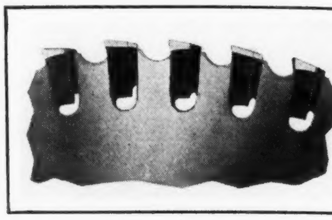
These reamers are available in both high-speed and carbon steel, in twenty sizes ranging from the B size having a diameter of 0.084 inch at the small end up to the U size having a diameter of 0.443 inch at the small end. Three small sizes, which are made in carbon steel only, have diameters at their small ends of 0.058, 0.066, and 0.075 inch, respectively.

Morse Diemakers' Reamer which is Tapered to Give Desired Die Clearance

The method of making dies by the use of these reamers consists of outlining the shape desired with closely drilled holes and then using a reamer to join the holes so that the central piece will drop out. After this is done, the reamer serves as a spiral milling cutter, being run along the outline of the die edge to finish the profile to size and give the required clearance. The larger size reamers have a free cutting action, and can often be used the same as helical milling cutters for profiling operations.

HUNTER INSERTED-TOOTH SAWS

Inserted-tooth saws of various sizes and thicknesses of plate have recently been developed by the Hunter Saw & Machine Co., 5662 Butler St., Pittsburgh, Pa. The teeth and the pockets in which they fit are both serrated, as shown in the illustration. These serrations lock the teeth firmly in the saw, thus preventing them from loosening while taking a cut. The serrations also provide a means for uniformly adjusting the teeth in or out. The teeth are ground while in place in the saw.



Hunter Saw with Inserted Teeth

OSTER PIPE THREADING AND CUTTING TOOL

A pipe threading tool provided with universal guides that automatically center the pipe has recently been placed on the market by the Oster Mfg. Co., 2057 E. 61st Place, Cleveland, Ohio, under the trade name of "Leader." This tool has a capacity for threading and cutting pipe in sizes from 1 to 2 inches. It is claimed that the universal pipe guides and the fully adjustable dies, together with other features of construction, make it possible to perform threading and cutting operations easily and quickly.

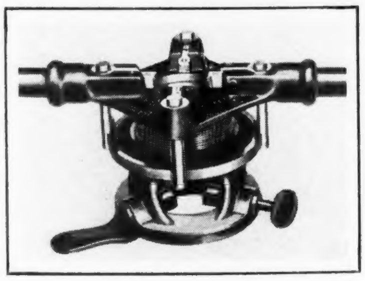


Fig. 1. Oster Plain Pipe Threader and Cutter

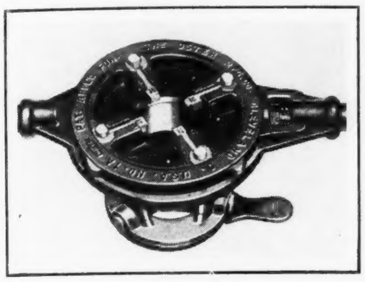


Fig. 2. Ratchet Type of Oster Pipe Threading Tool

The tool is available in two types. The No. 1 type, shown in Fig. 1, is a plain tool, while the 1-A type, Fig. 2, is of a ratchet construction. The ratchet mechanism is built around the dies where the stress is greatest. This feature is said to lessen the effort required in cutting threads and to permit more freedom of action when working close to a wall. The ratchet can be set for forward or reverse operation or it can be locked so that the action is the same as that of the plain tool.

DANLY LARGE DIE SETS

A complete line of large die sets, particularly adapted for such work as the production of automotive parts, farm implements, and refrigerator cabinets, has recently been placed on the market by the Danly Machine Specialties, Inc., 2112 S. 52nd Ave., Chicago, Ill. These sets are suited for the use of progressive dies performing two or more operations at one stroke of the press.

The line consists of four-post and two-post rectangular die sets, four-post square die sets, two- and three-post long and narrow die sets, together with heavy-duty guide posts and bushings for these sets. Altogether, there are five different types and eighty-five different sizes. Large die sets, like the one shown in Fig. 2, are provided with notches to prevent slings or lifting chains from slipping. All edges of the dies are beveled, and one pin of each set is located 1/4 inch off center in order to prevent mistakes in assembling.

All sets are equipped with the Danly removable guide posts, which permit dies to be ground without removing them from the holder. The long narrow die sets, such as shown in Fig. 1, are equipped with bosses or pads for stripper bolts.

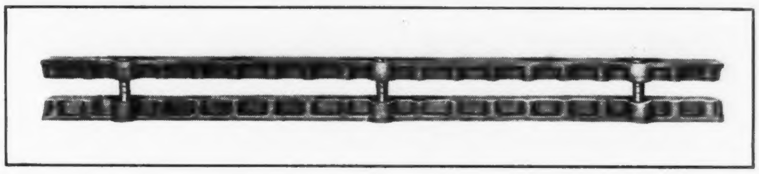


Fig. 1. Danly Long and Narrow Three-post Die Set having Bosses for Stripper Bolts

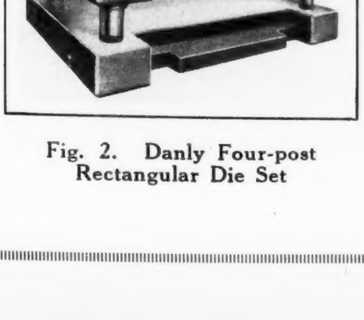
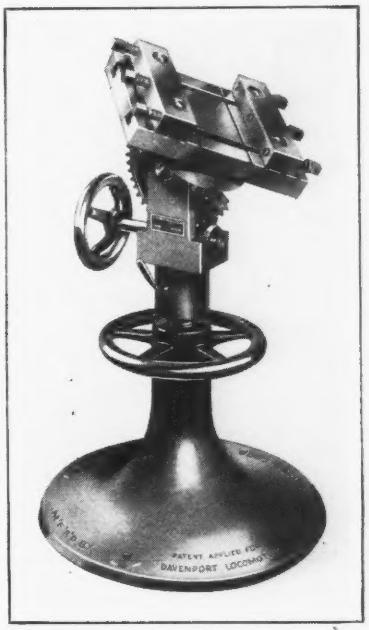


Fig. 2. Danly Four-post Rectangular Die Set

DAVENPORT UNIVERSAL DIE-HOLDING STAND

To facilitate the work of the diemaker by enabling him to easily set die-blocks at any desired height or angle, the Davenport Locomotive & Mfg. Corporation, Davenport, Iowa, has brought out the universal die-holding stand shown in the illustration. This stand is built in two standard sizes to accommodate blocks weighing up to 1500 and 3000 pounds, respectively. The multi-angle head fixture is made of steel. An adjustable clamp on either side slides in T-slots. The die is held firmly in place by six screws, which project through the clamps and engage grooves in the die-block.

The head fixture is actuated by a worm and segment gear operated by a handwheel. Any position can be obtained quickly by simply turning the handwheel until the desired angle is reached and then swinging the entire top assembly, which is pivoted, after which the work is locked in position.



Davenport Die-holding Stand

VAN DORN PORTABLE GRINDERS

A 7-inch "Flex-Disc" grinder and a 7-inch bench grinder have recently been brought out by the Van Dorn Electric Tool Co., 2978 Woodhill Road, Cleveland, Ohio. The "Flex-Disc" grinder, Fig. 1, has been developed as an

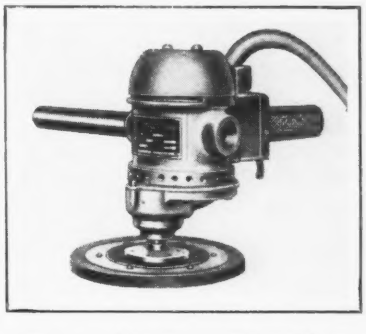


Fig. 1. Van Dorn "Flex-Disc" Grinder

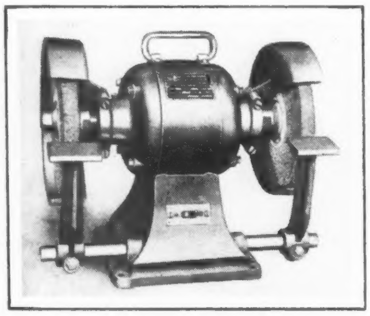


Fig. 2. Van Dorn Bench Grinder

addition to the 9-inch grinder of this company's manufacture. Equipped with a felt-backed abrasive disk, this grinder is adapted for such operations as smoothing welded and soldered joints and seams, cleaning dies, and smoothing metal surfaces before painting. Provision is made for changing the pipe handle to suit either right- or left-hand operation. This feature is now also incorporated in the 9-inch size.

The 7-inch bench grinder, shown in Fig. 2, is adapted for sharpening all kinds of edge tools and for light grinding operations. This grinder is equipped with ball bearings mounted in dustproof housings, and is dynamically balanced to insure smooth running at all speeds. It is furnished complete with grinding wheels, adjustable tool-rests, wheel guards, switch, and cable, and is available for all voltages and currents.

STANLEY ELECTRIC TOOLS

A bench grinder, three types of portable electric tools of different sizes, and a line of hole-cutting steel saws for use in electric drills are recently announced products of the Stanley Works, New Britain, Conn. The ball-bearing bench grinder No. 557, shown in Fig. 1, is designed primarily for factory or garage use. This machine is furnished with two 7- by 3/4-inch wheels. One coarse- and one fine-grain wheel are regularly furnished. Wire brushes and buffing wheels can also be used if desired.

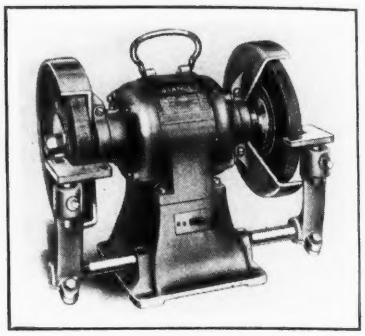


Fig. 1. Stanley Bench Grinder

Fig. 2 shows the construction of two "aerial" grinders designated as Nos. 565 and 566, which are fitted with 5- and 6-inch wheels, respectively. These grinders are equipped throughout with ball bearings, and have universal motors, controlled by a switch conveniently located in the handle. An eye-bolt and spring are provided for suspending the grinder above work.

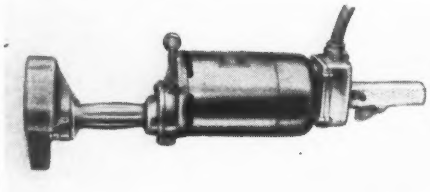


Fig. 2. Stanley Aerial Grinder

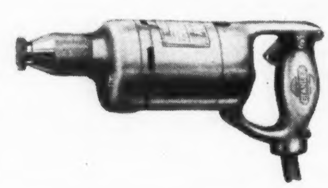


Fig. 3. Ball-bearing Screwdriver

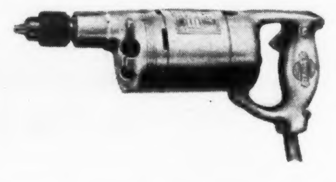


Fig. 4. Stanley Electric Drill

Two electric screwdrivers, one of which is shown in Fig. 3, are included in the new products. The No. 1 driver illustrated is capable of driving screws up to the No. 12 size and 2 inches long. The No. 2 driver is capable of driving screws up to No. 16, 3 1/4 inches long. This driver will also handle lag screws 5/16 inch by 4 inches long, and bolts and nuts up to the 3/8 inch size. A complete line of screwdriver bits can be furnished.

The No. 141-A electric drill shown in Fig. 4 is designed to use drills up to 1/4 inch. It is intended for production work, and is particularly well adapted for use in airplane, automobile, and woodworking plants. The straight-line design permits the drill to be used in close quarters. The motor is of the universal type, operating on either direct or alternating current. The heavy-duty three-jaw chuck has a no-load speed of 3000 R.P.M.

The high-speed steel hole saws are intended for rapidly cutting holes from 3/4 to 3 1/2 inches in metal and wood. The blades are so designed that they can be quickly replaced in the holder. The saws are especially adapted for automotive and electrical work. Only one mandrel is required for the various sizes.

Gibb Meter for Determining the Pressure of Electrodes

GIBB WELDING-MACHINE PRESSURE METER

A meter for determining the pressure, in pounds, exerted by the electrodes of a welding ma-

chine has recently been placed on the market by the Gibb Welding Machines Co., Bay City, Mich. This meter enables the operator to set the machine to give the exact pressure desired and to record the pressures that give the best results on different jobs. Thus, the machine can be quickly set to duplicate any previous work. The gage operates by hydraulic pressure, an oil reservoir being formed by seam-welding together the edges of two stamped disks. The seam thus produced is leakproof and pressure tight.

To determine the welding pressure, the oil-filled disk is placed between the electrodes of the welding machine and the pressure applied. The indicating gage of the meter then registers the pressure. The meter has a polished chrome-plated surface and weighs about 2 pounds.

ALLIANCE SHOP AND TOOL-ROOM ACCESSORIES

A line of shop and tool-room accessories recently placed on the market by the Alliance Tool Co., Alliance, Ohio, includes the adjustable angle-plate shown in Fig. 1, the drilling machine vise shown in Fig. 2, and the parallels, V-blocks, and planer jacks illustrated in Figs. 3, 4, and 5.

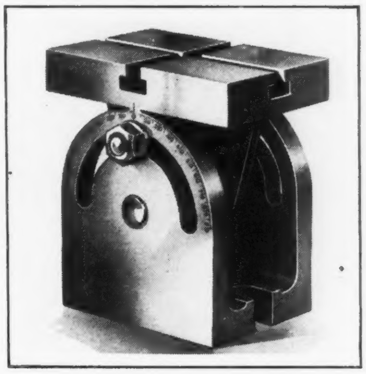


Fig. 1. Alliance Adjustable Angle-plate for Tool-room Work

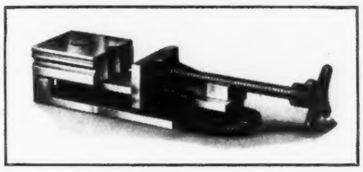


Fig. 2. Drilling Machine Vise

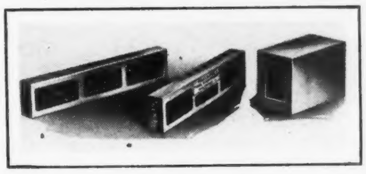


Fig. 3. Ribbed and Box Parallels

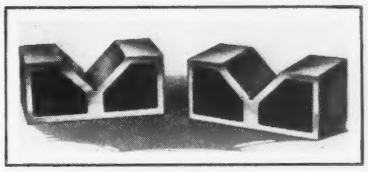


Fig. 4. Light Weight V-blocks

The angle-plate can be adjusted through an angle of 180 degrees, and is provided with T-slots for clamping the work. This tool is made in two sizes, and is adapted for such tool-room operations as laying out, checking, and machining light work. One size has a table 4 by 6 inches and a height of 6 5/8 inches, and the other size, a table 8 by 12 inches and a height of 9 5/8 inches.

The drilling machine vise is built in three sizes, having openings of 3 1/2, 4 1/2, and 6 1/2 inches. The principal feature of this vise is a rotatable jaw having four faces of different shapes for holding various kinds of work. Rapid operation is provided by the quick-acting screw, which can be lifted out of contact with the half-nut so that the jaw can be brought quickly to the work.

The ribbed parallels are made of malleable iron; they are furnished singly, in pairs, or in a complete set of ten sizes ranging from 3/8 by 3/4 by 6 inches up to 1 1/2 by 3 by 16 inches. All sizes are ground square and accurate to within limits of 0.0005 inch. The box parallel is made in sizes from 2 by 2 1/2 by 3 3/4 inches up to 6 by 12 by 12 inches.

The V-blocks are light in weight and have cored recesses which provide means for clamping. They are made in three sizes, the No. 1 size being 2 3/4 by 3 1/4 by 6 1/4 inches; the No. 2, 6 by 6 by 6 inches; and the No. 3, 8 by 8 by 8 inches.

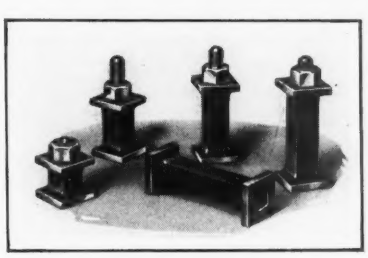


Fig. 5. Planer Jacks with Ground Ends and Edges

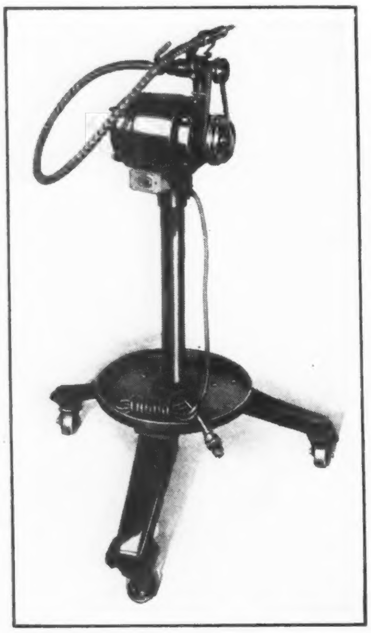
The planer jacks are finished on the ends and edges by grinding. When the screws are removed, they can be conveniently used as solid blocks or packing for setting up work on planers, milling machines, and shapers. These jacks are made in 2-, 3-, 4-, 5-, and 6-inch sizes.

HASKINS HIGH-SPEED FLEXIBLE SHAFT EQUIPMENT

A line of equipment of the flexible-shaft type for performing grinding operations on drop-forging dies has recently been developed by the R. G. Haskins Co., 4634 W. Fulton St., Chicago, Ill. This equipment is designed to operate continuously at high speed without vibration, in order to obtain high efficiency in the use of very small grinding wheels and points. The spindle is equipped with ball bearings, and designed to permit the use of small wheels in close quarters. Various types of interchangeable emery-wheel mandrels are provided, so that only a few seconds are lost in changing from one wheel to another.

The countershaft is mounted in Timken roller bearings. All parts are made to standard gages and are interchangeable. Bearings can be replaced in a few minutes, and no tools are required for changing speeds or taking up the belt tension. Various combinations of pulleys can be furnished to give the spindle speeds required.

The equipment illustrated is known as the HS-4 type, and is furnished with a 1/3-horsepower

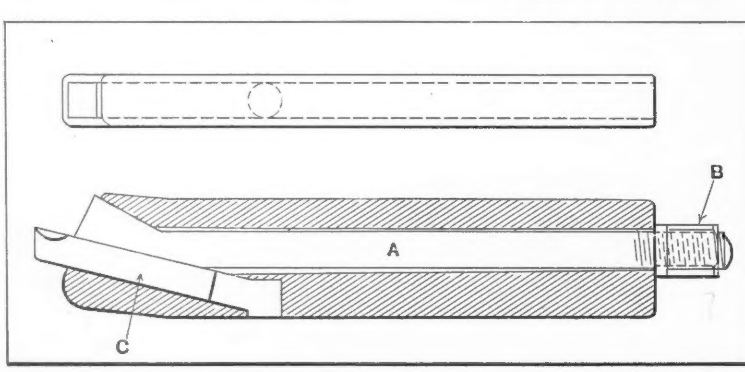


Haskins Equipment for Grinding Forging Dies

motor which runs at a speed of 3500 revolutions per minute, giving spindle speeds up to 9500 revolutions per minute. Wheels up to 2 inches in diameter can be used with this equipment. A spindle speed of 12,000 revolutions per minute is obtainable with the HS-2 equipment which is driven by a 1/4-horsepower motor. The HS-5 equipment is driven by a 1/2-horsepower motor, runs at a spindle speed of 4500 revolutions per minute, and takes wheels 4 inches in diameter.

WEDGE-CLAMP TOOL-HOLDER

In a tool-holder being introduced on the market by the U. S. Tool & Machine Works, 27 Thames St., New York City, the tool bit is gripped securely by a wedge-type clamp *A* (see accompanying illustration) which is tightened from the rear end. With nut *B* loosened on the shank of the clamp, the tool bit *C* can be conveniently brought into the desired position relative to the work and then held while the nut is tightened to exert pressure on the bit. This is accomplished as the wedge portion of the clamp is pulled downward on the upper side of the bit when the clamp is drawn toward the rear of the tool-holder.

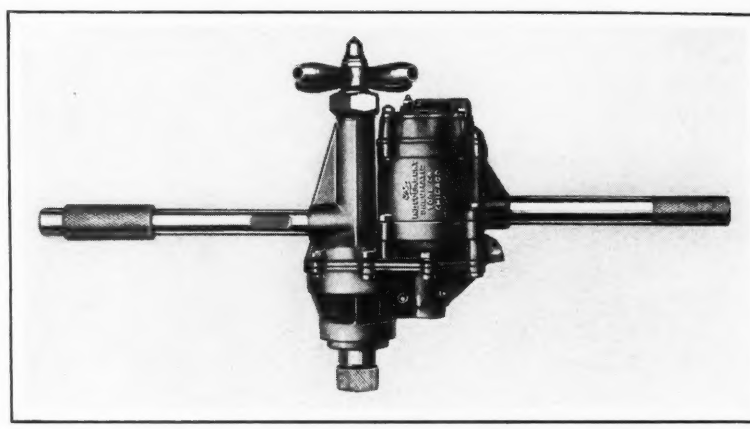


Tool-holder with Wedge Type of Bit Clamp which is Tightened from Rear End

This tool-holder is designed to facilitate the correct repositioning of tools after they have been removed from machines for sharpening. In placing the holder in a toolpost, it is unnecessary to swivel the latter and thus disturb the setting. Since the holder is only slightly wider than the shank of solid tools, it can be easily adjusted in toolposts. Another feature claimed for this holder is that bits are never snapped off, and can be used until reduced to very small pieces. Various sizes of the tool-holder are made for use on different types of machine tools. The holder, wedge clamp, and nut are made of steel and are all hardened.

"THOR" ROTARY PNEUMATIC DRILL

A pneumatic drill known as the "Thor 275" has recently been developed by the Independent Pneumatic Tool Co., 606 W. Jackson Blvd., Chicago, Ill. This tool is of the rotary type. It has a capacity for drilling holes up to 1 1/2 inches, and for reaming holes up to 1 1/8 inches. Its governed free speed is 350 revolutions per minute, and it carries a 50-pound load at the free running speed. Under a 100-pound load, the reduction in speed is only 30 per cent. Ball bearings are used throughout the tool, including the spindle and gear. The arrangement of the spindle is such that the tool can be used close to a wall without removing the dead handle. The weight of the drill is 35 pounds.



"Thor" Rotary Pneumatic Drill

REED-PRENTICE JIG BORER AND VERTICAL MILLER

The No. 5 jig borer and vertical miller recently brought out by the Reed-Prentice Corporation, Worcester, Mass., which was illustrated on page 104 of

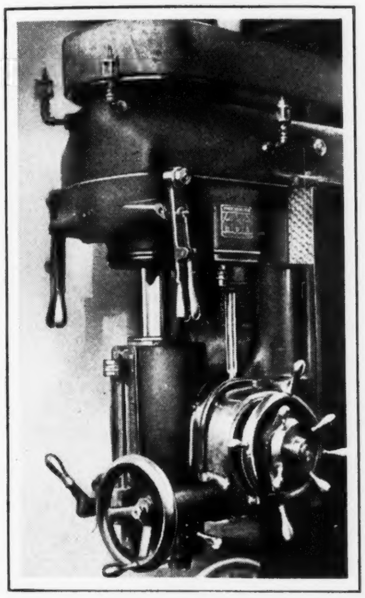


Fig. 1. Power Down Feed Built into Reed-Prentice Jig Borer

October MACHINERY, was shown equipped with a hand feed to the spindle. This machine may also be provided with a power spindle down feed built into the head, as shown in Fig. 1 of the present article. Three feeds, of 0.0025, 0.005, and 0.010 inch, are available through the lever at the right of the top gear-box.

Fig. 2 shows a close-up view of the longitudinal and cross table indicating devices used in making accurate settings of the machine. Two dial indicators for measuring in ten-thousandths of an inch are shown, as well as two differential micrometer heads, one for longitudinal and one for cross settings, and end measures. The end measures and micrometer heads are placed between adjustable stops and the dial gages. Fig. 1 of the previous article shows a detail of a differential micrometer head. Two of these heads, with twelve end measures, provide for adjustments ranging from 1 to 12 inches in increments of 0.0001 inch.

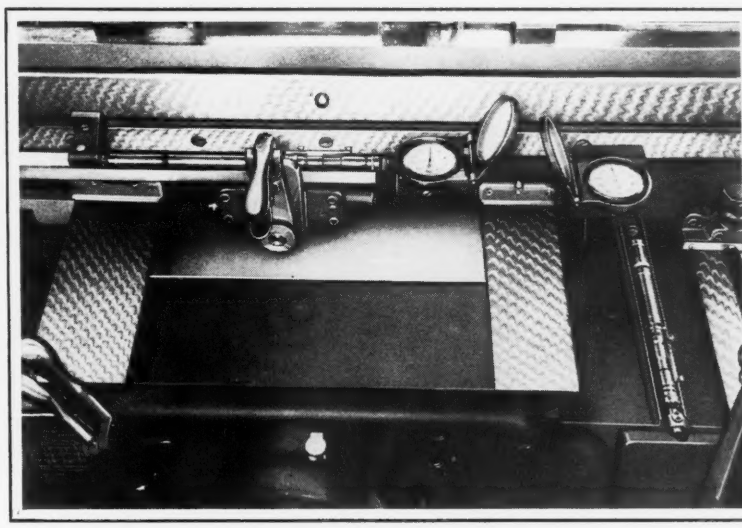
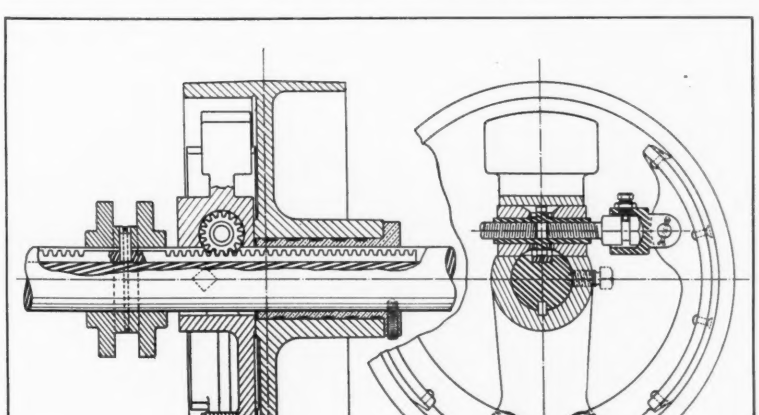


Fig. 2. Longitudinal and Cross Table Indicating Devices

"DURO" FRICTION-DRIVEN COUNTERSHAFT

A friction-driven countershaft recently placed on the market by the Duro-Friction Clutch Co., Grand Rapids, Mich., is operated by a rack-and-pinion mechanism. The expansion unit is made up of studs having right- and left-hand threads which enter opposite ends of the hub section of the pinion. When the pinion is turned by means of the rack, the two threaded studs are forced out, causing two shoes to come in contact with the inner surface of the driven pulley. The friction face of the shoes can be worn away to a depth of about 5/16 inch before any adjustment is required. All parts are standardized, and provision has been made for quickly replacing the friction shoes. Two sizes of the equipment are made to take care of all general requirements.

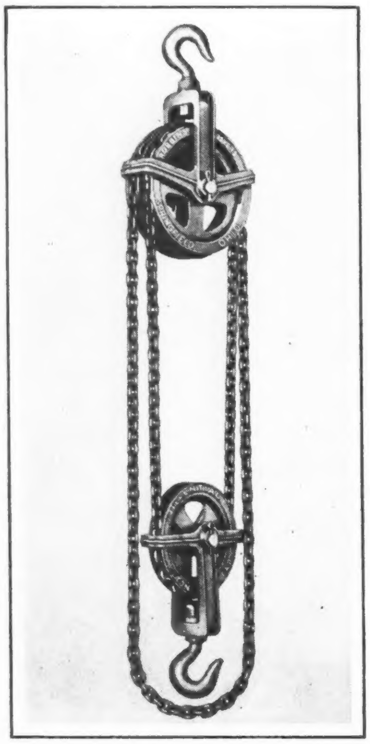


Assembly of Friction Clutch Used on "Duro" Countershafts

ROBBINS & MYERS DIFFERENTIAL CHAIN HOISTS

Differential chain hoists manufactured in five sizes having capacities ranging from 1/4 to 2 tons have recently been placed on the market by Robbins & Myers, Inc., Springfield, Ohio. Timken thrust bearings are used in the lower hook of these hoists to permit the load to be easily turned and to reduce the wear on the chain and the upper sheave wheel that is ordinarily caused by the twisting of the chain.

The sheaves are made of "Aremite," an alloyed iron pro-



Robbins & Myers Differential Chain Hoist

duced in the company's foundry. It is claimed that this metal has a tensile strength equal to twice that of ordinary gray iron and that it possesses unusual hardness and durability. With the exception of the chains, the entire hoist is finished in aluminum to protect it against damage from exposure. The chains are heat-treated and are electrically welded.

WIESMAN IMPROVED PUNCH PRESS GUARD

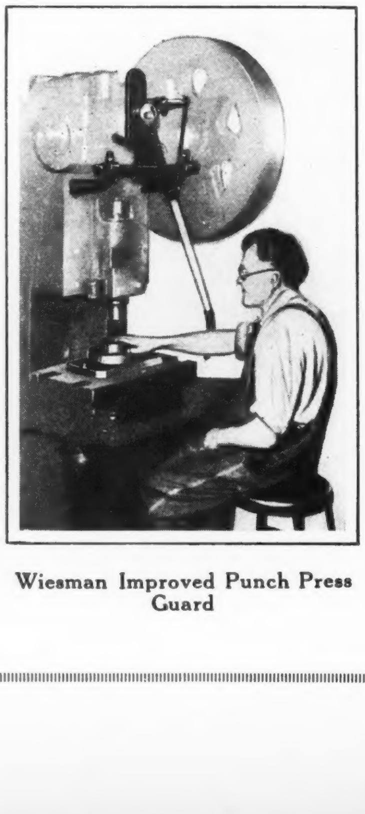
Improvements that consist mainly in the substitution of new materials for certain parts, have been made in the safety guard for punch presses manufactured by the Wiesman Mfg. Co., 31-35 S. St. Clair St., Dayton, Ohio. The general design of this guard was described in November, 1922, MACHINERY, page 244. The guard sweeps across the entire length of the punch press bolster plate during half of the downward stroke of the ram. This means that both hands of the operator are moved away from the dies before they are closed. During the first half of the upward stroke, the guard returns beyond the center of the ram, which allows the operator to feed the work rapidly.

The durability of the new guard has been increased by making the arm of second-growth hickory wood, such as is used in the shafts of golf sticks. Steel stampings instead of iron castings are now used for several other parts.

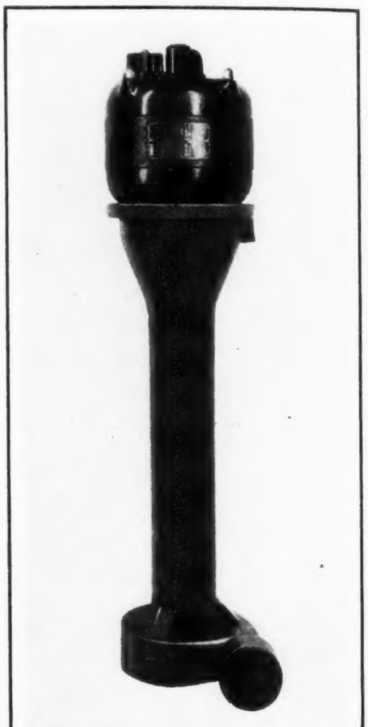
"BROWNIE" COOLANT PUMP

For supplying coolant to cutters or grinding wheels of machine tools the Equipment Co., 1202 W. Fort St., Detroit, Mich., has recently brought out the "Brownie" motor-driven pump shown in the illustration. This pump is particularly recommended for use on centerless grinders. No packing or screen is used in its construction, and no coolant can come in contact with the bearing. It is claimed that coolant loaded with grit or chips can be handled by this pump as efficiently as clean oil.

The ball bearing of the spindle is located within 1 inch of the impeller, the shaft of which is entirely self-aligning. The drive shaft, impeller, and protector tube are one unit and revolve together. The intake is at the top of the impeller, and there is no bottom or pan under the impeller in which grit or chips might collect.



Wiesman Improved Punch Press Guard



"Brownie" Impeller Type Motor-driven Coolant Pump

The pump is obtainable without a motor or with a 1/4-horsepower motor. The drive is direct at a speed of 1725 revolutions per minute, which gives a capacity of 50 gallons per minute. The maximum lift obtainable with this pump is 15 feet.

MICROMATIC CYLINDER HONE

A cylinder hone that expands automatically in finishing bores is being introduced to the trade by the Micromatic Hone Corporation, 1202 Maccabees Building, 5057 Woodward Ave., Detroit, Mich. The expansion mechanism is operated by a hardened and ground bushing *A*, Fig. 2, which is mounted directly above the cylinder bore. This bushing not only controls the finished bore size, but also acts as a guide for the hone in entering and leaving the bore. When entering the bushing, fingers *B* automatically expand the abrasive members to a predetermined size. The abra-

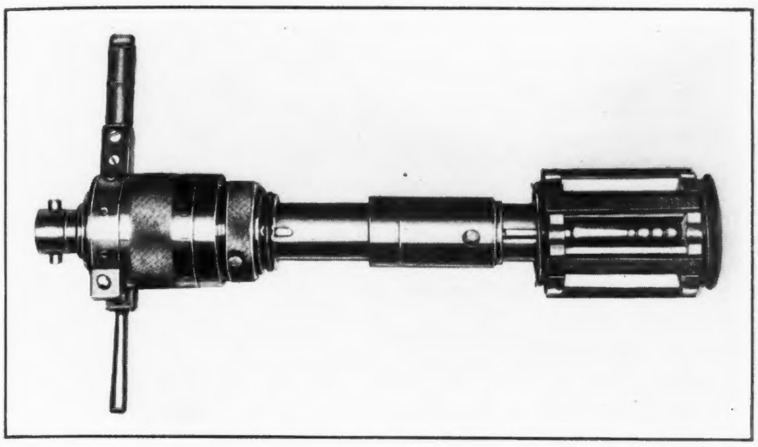


Fig. 1. Micromatic Cylinder Hone with Automatic Expanding Feature

sive members are then rotated and reciprocated a given number of strokes.

When the operation is completed, a throw-out attachment on the machine automatically raises the hone out of the cylinder bore. As fingers *B* leave the bushing, the abrasive members collapse automatically, leaving the tool ready to enter a new bore. Compression spring *C* cushions the pressure of the abrasive stones against the cylinder wall, and thus eliminates stone breakage.

This hone is of a single-cone type construction, and has one central supporting point for the stone-holders, which allows individual compensation for uneven wear. The angle of cone *D* is such that positive expansion is maintained to insure straight and round holes. The stones are mounted in light metal stampings.

For use in plants where a comparatively small production is divided between bores of different sizes, a Model B brake-type of hone is supplied. Interchangeable hone bodies of various sizes can be used in this model, and these are interchangeable with those of the Model A illustrated.

* * *

SPHERICAL TURNING METHODS

In an article on spherical turning methods to be published in December MACHINERY, a number of different attachments for spherical turning will be illustrated and described. Instructions will be given for setting up and operating the spherical turning attachments illustrated. The methods for making the various adjustments required will also be described in detail.

WIRE ROPE RESEARCH

Some fifty engineers broadly representative of the many fields interested in the construction and use of wire rope, recently met in New York at the Third Wire Rope Conference in the Engineering Societies Building and decided that it would be advisable to organize a cooperative research committee under the auspices of the Engineering Foundation and the American Society of Mechanical Engineers, with the cooperation of other interested technical organizations. This committee would make a study of the factors affecting wire rope life and would formulate rules of recommended practice for the use and inspection of wire rope, emphasize the factors to be considered in applying wire rope to various uses, and point out possible improvements that might be made in the design, materials, and fabrication.

* * *

At a meeting of the Screw Machine Products Association held in Chicago on October 17, action was taken to merge with the Screw Machine Products Institute, which was set up among members of the association early this year, to work out certain policies and plans centering largely around cost studies. This has now progressed to the extent that it was felt that all the members of the association should share in the benefits to be derived from this work.

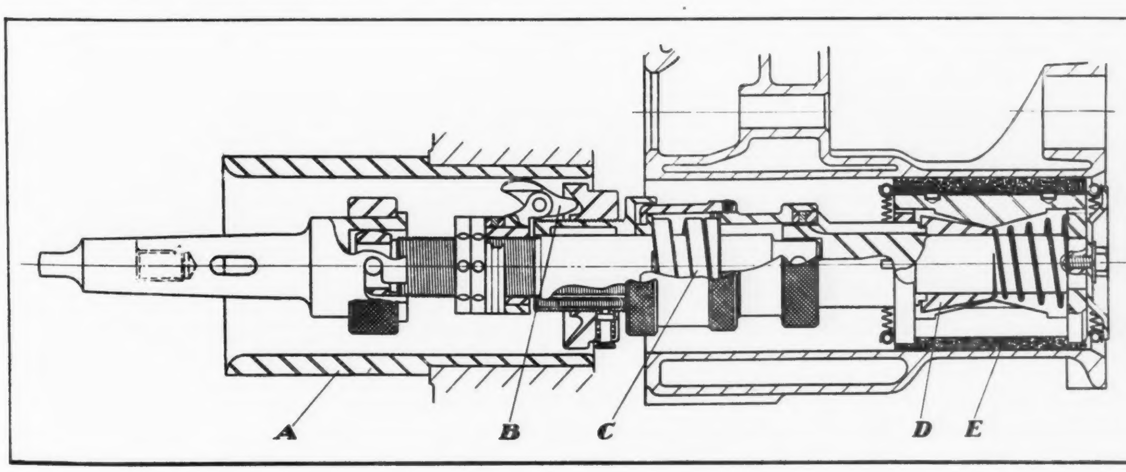


Fig. 2. Construction Details of the Micromatic Cylinder Hone

PERSONALS

Otto Abrahamsen, for twenty years treasurer of the Beaudry Co., Inc., Boston, Mass., and in charge of sales of Beaudry power hammers made by this company, has become affiliated with the Moloch Foundry & Machine Co., Kaukauna, Wis. Mr. Abrahamsen will be in charge of sales of the Moloch power hammer, with headquarters at Kaukauna. The company has under consideration adding a line of pneumatic forge hammers for heavy work and a line of board drop-hammers.

Otto Abrahamsen

Rudolph Nelson has been added to the staff of the United States Electrical Tool Co., Cincinnati, Ohio, and will be located at the Chicago branch of the company.

V. C. Baker has been appointed Chicago district sales manager of the Ampco Twist Drill Co., Jackson, Mich., with offices at 724 W. Washington Blvd., Chicago. Ill.

Ralph E. Flanders, manager of the Jones & Lamson Machine Co., Springfield, Vt., has been elected a vice-president of the American Society of Mechanical Engineers.

F. W. Peters has been appointed district manager of the transportation department of the Central District of the General Electric Co., at Chicago, succeeding G. Hall Roosevelt.

A. M. Sargent, formerly chief engineer of Q-C Engineering & Tool Sales, Inc., Detroit, Mich., was appointed vice-president in charge of engineering of that concern on October 1.

G. D. Scott, formerly chief engineer of the Hutto Engineering Co., Detroit, Mich., has recently been appointed chief engineer of Q-C Engineering & Tool Sales, Inc., Detroit, Mich.

Erwin J. Mohr has recently joined the Gunite Corporation, Rockford, Ill., in the capacity of manager of industrial sales. Mr. Mohr was for many years sales manager for the Kinite Corporation, of Milwaukee, Wis.

Fernand Turrettini, Director General of the Société Genevoise d'Instruments de Physique, Geneva, Switzerland, sailed October 18 after six weeks in the United States spent in visiting machine building plants in this country.

James G. Pattillo, Jr., has been appointed manager of the Pittsburgh branch sales office of the Wagner Electric Corporation, St. Louis, Mo. J. B. Holston has been made branch manager of the St. Louis sales office.

G. G. Jeter, manager of sales of the transformer accessory section of the General Electric Co., at Pittsfield, Mass., has been made manager of power apparatus sales of the newly consolidated General Electric Supply Corporation. His headquarters will be at Bridgeport, Conn.

R. E. Kelly, formerly manager of the Boston office of the Independent Pneumatic Tool Co., 606 W. Jackson Blvd., Chicago, Ill., has been made sales engineer for the eastern district with headquarters in New York City. John Ashton, salesman in the New York district, has been appointed manager of the Boston office.

H. O. K. Meister has been appointed assistant general manager of the Hyatt Roller Bearing Co., Newark, N. J. Mr. Meister has served as assistant general sales manager, and later, as general sales manager of the company since 1925. Prior to that, he was manager of the Western Division in Chicago. He has been associated with the company for over fifteen years.

H. C. Thomas has been appointed director of manufacturing stocks of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Mr. Thomas will be responsible for the methods used in the control of all raw materials, work in progress, and finished part stocks. He was formerly assistant general manager of the merchandising department, with offices in Mansfield, Ohio.

W. S. Rawley has been appointed sales representative of the Oliver Machinery Co., Grand Rapids, Mich., manufacturer of woodworking machinery and machine tools, in Indiana and Kentucky. Mr. Rawley's headquarters will be at 776 Emerson St., Indianapolis, Ind. W. C. Holland has recently been made representative at Beaumont, Tex., and G. C. Ross at Memphis, Tenn.

W. O. Forman, works manager of the Putnam Machine Works, Fitchburg, Mass., has resigned, and Harry W. Cross succeeds him as works manager. Mr. Cross was previously connected with the Westinghouse Electric & Mfg. Co., the Carnegie Steel Co., and the Miller Printing Co., and for the last five years has been vice-president of the Arch Machinery Co., Pittsburgh representative of Manning, Maxwell & Moore, Inc.

C. S. Stevenson, sales manager in Canada for the Gardner-Denver Co., Quincy, Ill., manufacturer of slush pumps, air compressors, steel forges, rock drills, and drill sharpeners, has been transferred from Cobalt to Toronto, where the main sales office of the company is located. Hal Crumbliss, sales representative in the St. Louis territory, now has his headquarters at El Paso, Texas, where he will cover southern New Mexico and Chihuahua.

Joseph Jacobson has been added to the sales staff of the Goodell-Pratt Co., Greenfield, Mass. Mr. Jacobson's territory will be the state of Michigan, and his headquarters will be at Detroit. John H. Metz has been given the territory comprising Richmond Hill, L. I., formerly assigned to E. C. Mesloh. The F. J. Keller Co., with a force of six salesmen, will take charge of the states of Texas, Oklahoma, Louisiana, and Arkansas, due to the rapid growth of business in that section.

Hibbard S. Greene, formerly vice-president and director of the Barber-Greene Co., Aurora, Ill., has been appointed assistant to the president of the Chain Belt Co., Milwaukee, Wis. Mr. Greene will coordinate the marketing plans of the Chain Belt Co., Sivyer Steel Casting Co., Federal Malleable Co., and Interstate Drop Forge Co., all of Milwaukee, Wis., as well as the Stearns Conveyor Co. of Cleveland, Ohio, a division of the Chain Belt Co. His headquarters will be at the Milwaukee plant.

Ralph S. Cooper has been elected president of the Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill., to succeed the late John D. Hurley. Mr. Cooper was closely associated with Mr. Hurley for over twenty-six years, and the policies of the company established by Mr. Hurley will be carried on in every detail. Mr. Cooper graduated from Cornell in 1903 as a mechanical engineer, and has been with the company ever since. After a year in the shop, he went into the sales department at Pittsburgh and soon afterward was made manager of the New York office, later becoming eastern manager. In 1917, he was elected vice-president in charge of eastern sales, and was transferred to Chicago early in 1918 as vice-president and general sales manager.

Ralph S. Cooper

He spent the years 1920 and 1921 in Europe opening up the company's office in Great Britain and establishing agencies throughout the Continent. On his return to the United States in 1921, he became general manager in charge of all departments of the company, which work he has carried on for the last eight years.

C. EDGAR ALLEN, Editor of the British publication *Machinery* of London, sailed from the United States October 12 after a three weeks' visit, during which time he visited the Machine Tool Exposition in Cleveland, as well as leading manufacturing plants in New England, Pittsburgh, Cleveland, Detroit, and Cincinnati. Mr. Allen, who has visited all the important machinery exhibitions in Europe for the last thirty years, was greatly impressed by the size and character of the Cleveland Machine Tool Exposition.

W. S. RUGG, vice-president of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has been appointed on the committee for the award during the next five years of the Edison Medal given by the American Institute of Electrical Engineers for meritorious achievements in electrical science, engineering, or arts. L. W. MORROW, editor of the *Electrical World*, and R. F. SCHUCHARDT of the Commonwealth Edison Co., were also appointed members of the committee. SAMUEL INSULL of Chicago is chairman.

F. B. CALDWELL, vice-president of the Chicago plant of the Link-Belt Co., has resigned on account of ill health. W. C. CARTER, formerly vice-president in general charge of production at all Link-Belt plants, will assume the duties of vice-president and general manager of the Chicago plant. E. J. BURNELL, who is manager of the Pittsburgh office, has been appointed sales manager of the Western Division, with headquarters at Chicago. NELS DAVIS, from the Chicago engineering sales force, succeeds Mr. Burnell as manager of the Pittsburgh office.

DR. BERNARD HAGUE, principal lecturer in electrical engineering at the University of Glasgow, Scotland, has accepted the invitation of the Polytechnic Institute of Brooklyn to serve as visiting professor of electrical engineering at the Institute for the present academic year. Dr. Hague is a member of the Institution of Electrical Engineers, the author of several standard works on electrical theory and measurements, and is a recognized authority in this field. He will have charge at The Brooklyn Polytechnic Institute of the conduct of graduate study and research in electrical engineering in the new plan now being developed at that institution for the benefit of technical graduates in the metropolitan district who desire to earn advanced engineering degrees by evening study.

F. W. HIGHFIELD, managing director of the Highfield Electrical Co., Ltd., Coventry, England, has come to the United States to dispose of the American rights in certain patents and inventions now being successfully worked in Europe by the company with which he is associated. Mr. Highfield also wishes to acquire agencies or manufacturing rights for any new electrical inventions suitable for the British and European market. The patents include the Highfield electric dynamometer engine testing equipment; the Highfield gear-box and chassis testing machines; the Highfield aero engine testing equipment; automatic traffic control signal; automatically controlled electric drill; apparatus to protect portable electric drills and similar equipment; and a three- and six-cylinder radial engine with simplified cam gear. Mr. Highfield can be reached through Marks & Clark, 220 Broadway, New York City.

OBITUARIES

H. COLE ESTEP, vice-president of the Penton Publishing Co., Cleveland, Ohio, died suddenly of heart disease on September 30, aged forty-three years. Mr. Estep was born in Stampede Tunnel, Wash., and graduated from the University of Minnesota in 1908 as a mechanical engineer. In the same year he joined the editorial staff of the *Iron Trade Review*, which he represented first in Seattle, and afterward in Chicago. In 1914 he became engineering editor of that journal, which position he held for three years. He was editorial director of the Penton publications in 1918 and 1919, and European manager from 1919 to 1924. Mr. Estep was prominent in the affairs of the American Foundrymen's Association, of which he had been a director the past year. He had been chairman of the committee on international relations of that association for several years, and it was largely through his efforts that the plan was adopted of having exchange papers between that association and European foundry societies. He was secretary of the Foundry Equipment Manufacturer's Association and a member of the American Society of Mechanical Engineers, as well as of various societies in the iron and steel field.

LOUIS VAUGHAN HUBBARD, president of the Taft-Peirce Mfg. Co., manufacturers of special machinery, tools and dies, Woonsocket, R. I., and 233 Broadway, New York City, died suddenly of heart disease at his home in Montclair, N. J., on September 26, at the age of sixty-three years.

Mr. Hubbard was a graduate of Amherst College and shortly after his graduation took up the practice of law, later becoming a member of the firm of Noble, Jackson & Hubbard. At the time of his death he was vice-president of the First National Bank and Trust Co. of Montclair, and of the Watchung Title & Mortgage Co. He had a high reputation as a financier and left many friends in Montclair where he had lived since 1908.

TRADE NOTES

ACTIVE MACHINE & TOOL CO., 1220 W. 6th St., Cleveland, Ohio, has changed the firm name to TOOLS & GAGES, INC.

J. M. & L. A. OSBORN CO., Cleveland, Ohio, will handle the Cleveland territory sales of the line of "Minster" presses built by the Minster Machine Co., Minster, Ohio.

CENTRAL IRON & STEEL CO., Harrisburg, Pa., has moved its Boston office from the former location at 131 State St. to the Statler Office Building, Park Square. G. T. Armstrong remains in charge of this office.

U. S. ELECTRICAL MFG. CO., Los Angeles, Cal., has recently added another wing to its plant and installed new equipment, which will increase the production of U. S. motors approximately 50 per cent.

SAMSON-UNITED CORPORATION, Rochester, N. Y., has been formed to take over the business of the SAMSON CUTLERY CO. The same executives who directed the policies of the Samson Cutlery Co. will control the new concern.

REED-PRENTICE CORPORATION, Worcester, Mass., has appointed Joseph F. Pflum, 3721 St. Lawrence Ave., Cincinnati, Ohio, exclusive representative of the company covering its complete line of machine tools in the Dayton and Cincinnati districts.

LINDE AIR PRODUCTS CO., 30 E. 42nd St., New York City, has established a new Linde oxygen plant at 1628 Cascade St., Erie, Pa. J. J. McKeen is superintendent of the plant, and R. S. Hamilton, district superintendent, with headquarters at East Buffalo.

HAMMOND MACHINERY BUILDERS, INC., Kalamazoo, Mich., is the new name under which the business formerly known as the HILL-CURTIS CO. will be conducted in the future. The Hammond Machinery Builders, Inc. manufacture sawing machinery of various types.

A.B.C. MFG. CO., 221 S. 4th St., Quincy, Ill., has taken over the old established manufacturing plant hitherto known as B. BARMEIER, specialty manufacturer, and is enlarging and re-equipping the plant to handle contract manufacturing as well as a line of the A.B.C. Co.'s specialties.

COMET ENGINE CORPORATION, 215 S. Dickinson St., Madison, Wis., has taken over the business of the Aircraft Engine Corporation of Oakland, Calif., and the Comet airplane engine will hereafter be built in Madison, Wis., in what was formerly the Northern Works of the Gisholt Machine Co.

OHIO SEAMLESS TUBE CO., Shelby, Ohio, announces that its $400,000 plant expansion program will be completed December 1, and the new buildings and equipment will be in operation by the first of next year. This expansion will increase the productive capacity of the company 40 per cent.

WAGNER ELECTRIC CORPORATION, 6400 Plymouth Ave., St. Louis, Mo., has opened a new branch sales office at 734

GOOD TOOLS *do*

An investment in Brown & Sharpe Tools is the most economical tool investment you can make.

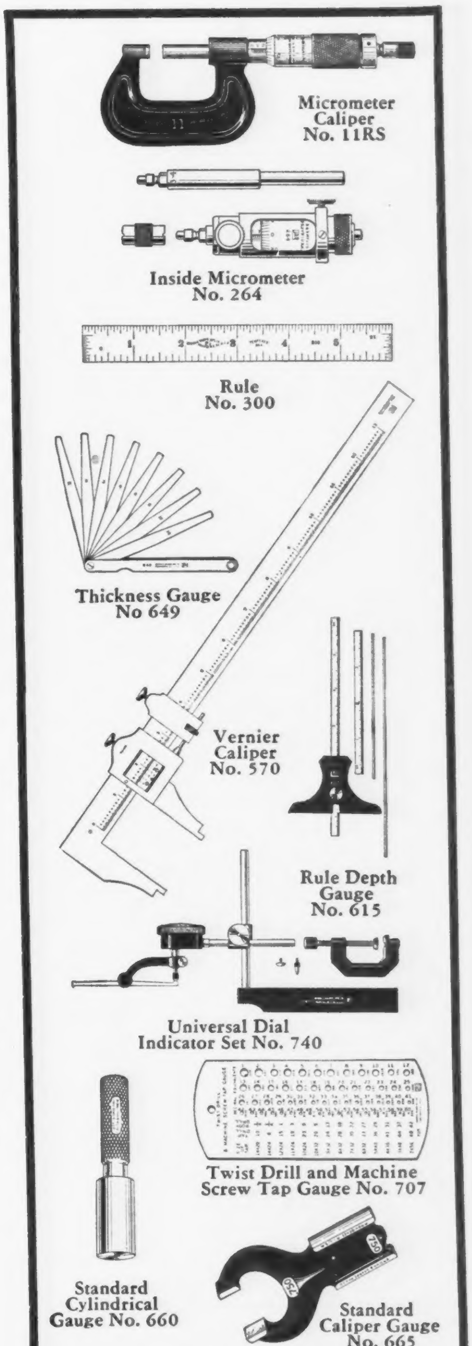
every job BEST

Your production and its cost depend upon your men and the Tools they use—

SKILLED workmen with good tools keep production at its highest level. With good tools men work rapidly and they work better. Good tools impart confidence. Their accuracy, convenience of design and handiness help to maintain the quality of the work and speed up its production. In addition, there is less loss due to imperfect measurements and less rejection for faulty fits in assembly. In short, all along the line, good tools make a continuous and appreciable saving in the year's manufacturing costs.

Their accuracy and time-saving handiness make Brown & Sharpe Tools the most efficient equipment a manufacturer can provide for his workmen. They insure the utmost accuracy in each operation and in the finished product. And the workmen like them. Brown & Sharpe Tools stand up better under the wear and tear of the shop—their accuracy is long-lived.

The Brown & Sharpe No. 31 Catalog is a buying guide for quality tools and cutters. Keep a copy on hand for reference.



BROWN & SHARPE

BROWN & SHARPE MFG. CO. PROVIDENCE, R. I., U. S. A.

Allen Bldg., Dallas, Tex., to cover the entire state of Texas and parts of Louisiana and Arkansas. Alfred B. Emrick has been placed in charge of the new office as manager.

BANTAM BALL BEARING Co., South Bend, Ind., has added a brass foundry to its plant, in which several different types of bronze castings required in the manufacture of ball and roller bearings are being made. C. O. Hiler, who has had many years of brass foundry experience, is in charge.

JOSEPH T. RYERSON & SON, INC., Chicago, Ill., have sold their complete line of table and floor type horizontal boring, drilling, and milling machines to the Ohio Machine Tool Co., of Kenton, Ohio. The Ryerson Company will, however, retain the sole rights as exclusive distributors of the line.

DETROIT MACHINE TOOL CO., 5057 Woodward Ave., Detroit, Mich., manufacturer of Detroit five-spindle semi-automatic horizontal drilling machines, recently appointed the Frank E. Artz Machinery Co. of Chicago, Ill., and the Camm-Blades Machinery Co. of Milwaukee, Wis., representatives of the company.

STANLEY P. ROCKWELL CO., Hartford, Conn., has opened a new plant at 296 Homestead Ave., which will have complete chemical, physical, and metallurgical laboratories, as well as business offices for the sale of all heat-treating equipment and a machine shop for the manufacture of the Rockwell Dilatometer.

DANLY MACHINE SPECIALTIES, INC., 2112 S. 52nd St., Chicago, Ill., makers of standardized die sets, have recently opened a warehouse and assembly plant at 1444 E. 49th St., Cleveland, Ohio, with J. R. Fitzsimmons in charge. A complete stock of die sets and diemakers' supplies will be carried at the new warehouse.

AMPCO TWIST DRILL CO., Jackson, Mich., has established a new branch office at Dayton, Ohio, with P. J. McMullen of the McMullen Tool & Supply Co., 1702 E. 3rd St., as manager. In view of this change, the Cincinnati office has been discontinued, and this territory will also be taken care of by Mr. McMullen.

PALMER-BEE CO., Detroit, Mich., has appointed George M. Demorest district representative of the company for Pittsburgh and vicinity. Mr. Demorest will cover the Palmer-Bee complete line, which includes conveyors, speed reducers, flexible couplings, I-beam trolleys and switches, and coal and ash handling systems.

CENTRAL ALLOY STEEL CORPORATION, Massillon, Ohio, has authorized an expenditure of more than $600,000 for important improvements at both the Massillon and Canton plants. These improvements include the installation of continuous pack and pair furnaces, electric drive equipment, and continuous furnaces.

LUDLUM STEEL CO. announces that it has discontinued the Cleveland office at 5140 Superior Ave., and all business in the Cleveland district will be handled hereafter from the office at 1593 E. 41st St. T. C. Sherman is local manager of the Alloy Division, and W. H. White, local manager of the Tool Steel Division at the latter office.

H. D. CONKEY & CO., Mendota, Ill., manufacturers of overhead traveling cranes, are building an addition to their plant that will double the present capacity. The addition is to be used for the fabrication of materials only. The company announces that it is being represented by the Cleveland Tool & Supply Co., Cleveland, Ohio, in the Cleveland district.

ACME ELECTRIC WELDER CO., 5621A Pacific Blvd., Los Angeles, Calif., manufacturer of Acme "Hot Spot" electric welders, has removed its eastern offices from the Bourse Building, Philadelphia, to 960 Rising Sun Ave., which will provide better facilities for exhibiting Acme welders. George M. Hessdoerfer is the factory representative and engineer for the entire eastern district.

AMERICAN CHAIN CO., INC., and Associate Companies, Bridgeport, Conn., announce the removal of the Chicago offices to new quarters on the seventeenth floor of the Chicago Daily News Building, Room 1765. The Associate Companies include the Ford Chain Block Co., Highland Iron & Steel Co., Manley Mfg. Co., Page Steel & Wire Co., Reading Steel Casting Co., and Wright Mfg. Co.

MICROMATIC HONE CORPORATION is a recent reorganization of the Jeschke Tool Corporation, with offices at 5057 Woodward Ave. and a factory at 14220 Mack Ave., Detroit, Mich. The development and field engineering service work will continue to be headed by Frank Jeschke and G. M. Calvert. The officers are as follows: President and general manager, Kirke W. Connor; vice-president in charge of engineering, Harold W. Holmes; and treasurer, George E. Eyestone.

ECLIPSE INTERCHANGEABLE COUNTERBORE CO., has just moved into its new factory and office building at 7410-30 St. Aubin Ave., Detroit, Mich. The new structure is a two-story building, 65 by 120 feet, the second floor of which will be given over entirely to offices and the employes' locker rooms. The new quarters afford approximately 20,000 square feet of manufacturing space. Considerable additional equipment has been installed, and the force has been increased from 80 to 150 men.

D. S. MAIR MACHINERY CORPORATION, 505 Esperson Building, Houston, Texas, has been formed by D. S. Mair of the D. S. Mair Machinery Co. and Charles J. Harter, railroad representative of Joseph T. Ryerson & Son, Inc. Mr. Harter will have charge of the Dallas office at 4521 Edmondson Ave. The new corporation will represent Joseph T. Ryerson & Son, Inc., in their machinery sales in Texas, Louisiana, and the southern part of Arkansas. They will also represent the Whiting Corporation, Harvey, Ill., and the Landis Machine Co., Waynesboro, Pa.

MARYLAND MACHINERY CO. has been incorporated under the laws of the State of Maryland by William J. Leppert, formerly with the Aumen Machinery Co., and T. H. King, formerly with the Landis Tool Co. The company will operate in the state of Maryland, part of West Virginia and the District of Columbia, and will have exclusive selling rights for some of the leading machinery manufacturers of Cincinnati, Ohio, the Middle West, and the New England states. The officers of the company are as follows: President, Thomas H. King; secretary and treasurer, William J. Leppert.

ALLIED DIE-CASTING CORPORATION has recently completed a new plant at Long Island City, N. Y., which has been provided with up-to-date equipment throughout. The new building is a four-story construction, and contains 75,000 square feet of floor space. In planning this building, particular attention has been given to providing comfort for the employes, shower baths having been installed for the use of the operators, as well as extensive rest and locker rooms. The entire plant has been designed and planned with the idea of conserving time and labor. A fully equipped metallurgical and chemical laboratory is located on the roof.

CENTRAL ALLOY STEEL CORPORATION, Massillon, Ohio, announces that the construction of the largest nitriding furnace in the world has been completed at the Canton Works. The new furnace will be utilized in casehardening Nitralloy by the nitriding process. Nitralloy is one of the important new alloys produced by the corporation under Krupp licenses. The facilities of the new nitriding furnace are at the disposal of manufacturers who need nitrided parts but who at present lack nitriding equipment in their own plant. Parts 23 feet long have been nitrided in this furnace, including such large pieces as crosshead guides for locomotives.

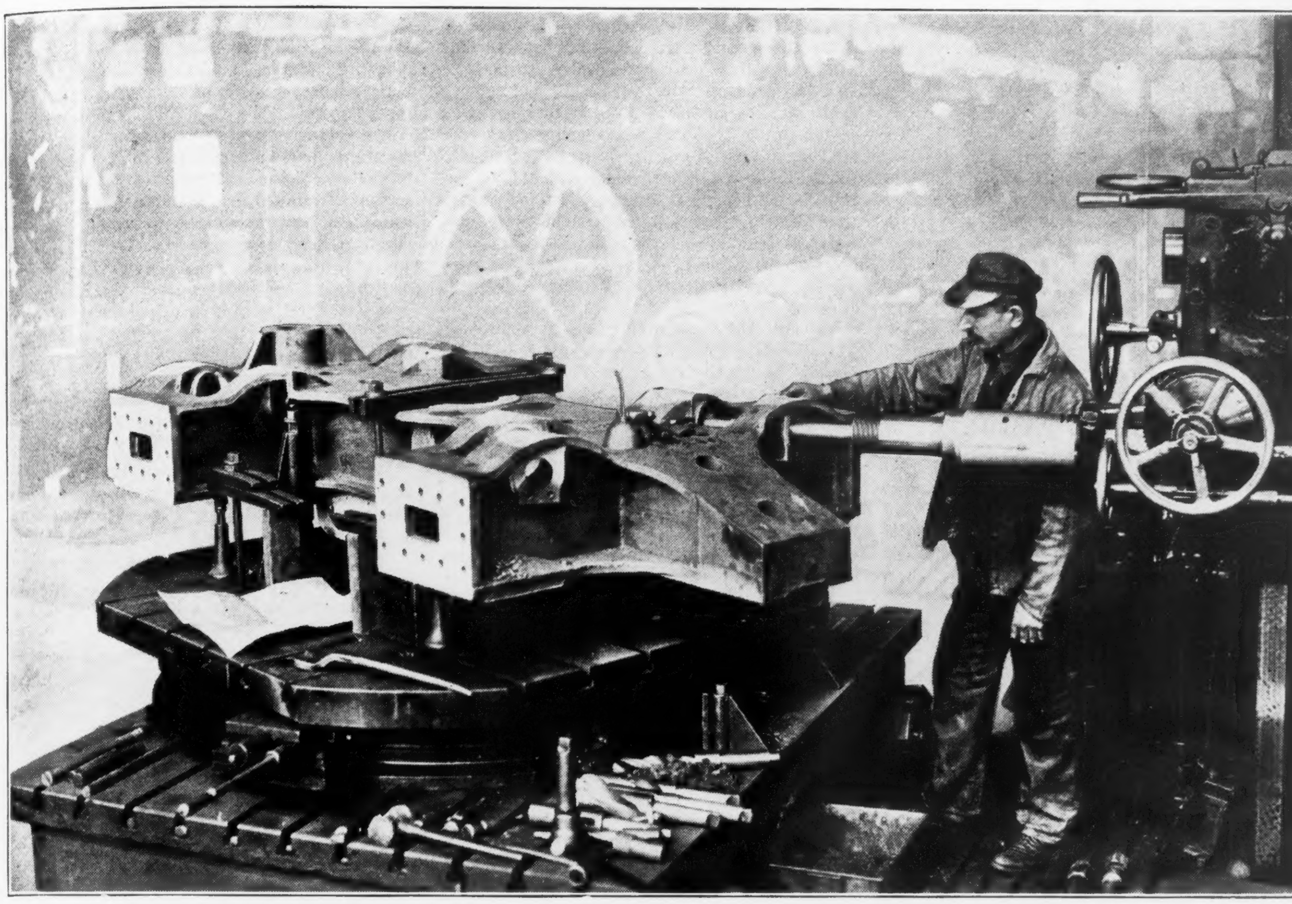
* * *

NEW PUBLICATION IN THE MECHANICAL FIELD

A new publication known as "Machine Design" has made its appearance. It is published by the Johnson Publishing Co., Cleveland, Ohio, and will be devoted to problems in machine design as they affect engineering, production, and sales. The first number appeared in September and dealt with a number of subjects of interest to machine designers.

* * *

At the fall meeting of the American Association of Engineers, held October 11 and 12 at the Brevoort Hotel, Chicago, Ill., the following officers were elected: President, H. A. Wagner; vice-president, James H. Griffin; treasurer, H. W. Clausen; and secretary, M. E. McIver.



Drilling and tapping a cast iron Base Plate with a Horizontal Drilling and Boring Machine.
The entire job—totaling 118 operations—handled with the one set-up.

Save Time and Labor — Handle the Entire Job from the One Set-Up

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One simple set-up—then uninterrupted operation. Drill the entire job—four sides—from the one setting, on a simple rotary table.—Or drill five sides on ordinary work with a universal tilting and revolving table.

The set-up job is easier too. The worktable is at the side of the drill with no overhanging parts to interfere. Drilling, too, is faster and cleaner. Drilling pressure is against a heavy vertical column. The chips fall away from the hole, keeping the drill clean.

The Horizontal Drill simplifies the handling of difficult pieces. It gives you a wider range of operation and greater ease in handling the general run of work. It will show a big saving in floor to floor time.

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COMING EVENTS

NOVEMBER 13-15—Annual convention of the International Acetylene Association to be held at the Congress Hotel, Chicago, Ill. A. Cressy Morrison, 30 E. 42nd St., New York City, secretary-treasurer.

DECEMBER 2-6—Annual meeting of the American Society of Mechanical Engineers at the Engineering Societies Building, 29 W. 39th St., New York City. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

DECEMBER 2-6—National Exposition of Power and Mechanical Engineering in the Grand Central Palace, New York City. Charles F. Roth and Fred W. Payne, managers, Grand Central Palace, New York City.

NEW BOOKS AND PAMPHLETS

1929 SUPPLEMENT TO BOOK OF A.S.T.M. STANDARDS. 293 pages, 6 by 9 inches. Published by the American Society for Testing Materials, 1315 Spruce St., Philadelphia, Pa. Price, $1.50.

This booklet is a supplement to the 1927 edition of the A. S. T. M. book of standards. The supplement contains 19 revised and 32 newly adopted standards relating to metals and non-metallic materials.

SPARKING OF STEEL. By E. Pitois. 89 pages, 6 by 9 inches. Published by the Chemical Publishing Co., Easton, Pa. Price, $2.

This is a book translated from the French containing information relating to the testing of steel by sparking. A chapter is devoted to the explanation of this method, and this is followed by a description of the appearance of the spark stream in grinding carbon steels, cast iron, and alloy steels. Information is also given on the photographic reproduction of sparks. The book has been translated and enlarged by John D. Gat, research metallurgist of the American Sheet & Tin Plate Co.

CHEMISTS' POCKET MANUAL. By Richard K. Meade. 533 pages, 4 by 6 inches. Published by the Chemical Publishing Co., Easton, Pa. Price, $5.

This is the fourth edition of a handbook containing tables, formulas, calculations, and physical and analytical methods for the use of chemists, chemical engineers, assayers, metallurgists, manufacturers, and students. Among the matter included are tables of specific gravities, weight and volume of substances, logarithmic tables, standard acid tables, alkali tables, physical properties of gases, heat, fuels, combustion, electricity, hydraulics, mineralogy, technical analysis, etc.

FORTY YEARS WITH GENERAL ELECTRIC. By John T. Broderick. 218 pages, 5 by 8 inches. Published by the Fort Orange Press, Albany, N. Y. Price $2.50.

The experience of the author during forty years association with a large corporation naturally contains much of historic and general interest. Mr. Broderick describes the origin and growth of the General Electric Co., and traces the remarkable success of this great organization to the spirit of its founders. The history of this corporation necessarily includes the story of outstanding scientific achievements, such as those of Steinmetz, Thomson, Whitney, and other pioneers in the electrical field. It also largely represents the history of applied electricity. The book is written in a readable style, and gives delightful glimpses into the personality of some of the great leaders in the electrical world.

MOTOR VEHICLES AND TRACTORS. By P. M. Heldt. 678 pages, 5 1/2 by 8 1/2 inches. Published by P. M. Heldt, Nyack, N. Y. Price, $8.

The present volume was written to take the place of Volume II of "The Gasoline Automobile." It has been issued under a new title because the scope of the work has been changed somewhat. The old volume deals with both design and production methods, while the new one deals with design only. More attention is given in the present book to heavy commercial vehicles, and agricultural tractors are also dealt with. While a certain amount of material, specifically mathematical discussion, has been taken from the old volume, the great bulk of the material is new. The book is intended as a text for students taking courses in automotive engineering, for home study by those engaged in automotive work of a technical character or those who wish to prepare themselves for such work, and for reference purpose in designing new automotive products.

MECHANICAL CATALOGUE. 1076 pages, 8½ by 11¼ inches. Published by the American Society of Mechanical Engineers, 29 W. 39th St., New York City. Price to non-members, $5.

This is the nineteenth annual edition of a work formerly known as "Condensed Catalogues of Mechanical Equipment." The book contains a classified catalogue section of 772 pages, comprising condensed, uniformly presented, and illustrated catalogue information covering the products of manufacturers of various classes of mechanical equipment. In addition to the catalogue material, a general classified directory of manufacturers in the mechanical field, containing a specialized cross-indexed list of mechanical equipment, with the names and addresses of the manufacturers, is included. The third section of the book contains a classified list of the members of the American Society of Mechanical Engineers who are engaged in the various branches of professional engineering practice. The present edition of this work shows a gain over the previous issue, having a total of 745 pages of catalogue data carried by 571 firms. There are over 5000 illustrations. The mechanical equipment directory contains 42,000 separate listings.

MAC RAE'S BLUE BOOK AND HENDRICKS COMMERCIAL REGISTER. 2640 pages, 8 1/2 by 11 inches. Published by Mac Rae's Blue Book Co., 18 E. Huron St., Chicago, Ill. Price, $10.

Purchasers of industrial materials and equipment who require a convenient means of keeping in touch with sources of supply of industrial materials and equipment will welcome the 1929 edition of this well-known industrial directory, which covers all the manufactured products in the United States. The present edition is published in the same form as previous ones. There are three sections, the first comprising an alphabetical list of manufacturers whose products are included in the classified section. This list includes, in many cases, branch offices and the names and addresses of local distributors. The classified material section contains a complete classified list of all the principal products manufactured in the United States, arranged alphabetically according to products, together with the names and addresses of the manufacturers. This section covers 2028 pages of three columns each. The final section in the book contains an alphabetical list of trade names of the various products listed, including the name and address of the manufacturers.

CHEMICAL ENGINEERING CATALOGUE (1929). 1205 pages, 9 by 12 inches. Published by the Chemical Catalog Co., Inc., 419 Fourth Ave., New York City. Special terms for distribution listed on page 4.

This is the fourteenth annual edition of a catalogue containing condensed and standardized catalogue data of equipment, machinery, laboratory supplies, heavy and fine chemicals, and raw material used in the industries employing chemical processes of manufacture. The first section of the book contains an alphabetical list of the firms whose products are catalogued. This is followed by a list of trade names of the products of firms using space in the volume. The third section comprises a classified alphabetical index of equipment and supplies, covering 88 pages. The fourth section contains illustrated catalogue data of equipment and supplies, arranged alphabetically according to the names of manufacturers, and covers 811 pages. This section is followed by a classified index of chemicals and raw materials, catalogue data of chemicals and raw materials, and a technical and scientific book section, which catalogues and briefly describes a comprehensive list of books on chemical and related subjects.

NEW CATALOGUES AND CIRCULARS

VISE PLATES. N. W. Ordway, Hartford, Conn. Circular outlining the principal features of the Connecticut universal angle vise-plate.

MOTORS. Century Electric Co., 1806 Pine St., St. Louis, Mo. Bulletin illustrating and describing Century Type SCN squirrel-cage induction polyphase motors.

CONTROLLING AND RECORDING EQUIPMENT. Bristol Co., Waterbury, Conn. Catalogue treating of Bristol's hot blast temperature control for blast furnaces.

MARKING STAMPS. Pittsburgh Stamp Co., 811 Canal St., Pittsburgh, Pa. Circular listing the various styles of "Thor" steel marking stamps made by this concern.

FLEXIBLE COUPLINGS. T. B. Wood's Sons Co., Chambersburg, Pa. Bulletin 168-A, containing data on this company's line of universal Giant flexible couplings.

RECORDING INSTRUMENTS. Bristol Co., Waterbury, Conn. Catalogue 2100, on Bristol recording psychrometers for determining relative humidity or atmospheric moisture.

SPEED REDUCERS. Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio. Catalogue 29-A, containing data on Ohio speed reducers, which are made in standard ratios for prompt shipment.

ARC-WELDING EQUIPMENT. Lincoln Electric Co., Cleveland, Ohio. Circular outlining the features of the new improved Lincoln "Stable-arc" welders. Several of the types are illustrated.

STEEL OFFICE AND FACTORY EQUIPMENT. Berger Mfg. Co., Canton, Ohio. Circular illustrating "Berloy" steel shelving and other storage equipment, steel filing cabinets, safes, desks, etc.

AUTOMOTIVE TOOLS. Reiff & Nestor Co., Lykens, Pa. Catalogue 11, listing the line of automotive tools made by this company, including piston-pin expansion reamers, valve reseating tools, and taps.

LUBRICATING SYSTEMS. Lubrication Devices, Inc., 50 S. Washington St., Battle Creek, Mich. Booklet illustrating the application of the Farval positive centralized system of lubrication on a variety of machines.

HIGH-TEMPERATURE CEMENT. Harbison-Walker Refractories Co., Pittsburgh, Pa. Booklet descriptive of the use of "Firebond" high-temperature cement for furnaces, coke ovens, gas plants, and similar service.

ELECTRIC HEATING EQUIPMENT. Commonwealth Edison Co., Chicago, Ill. Catalogue entitled "Electricity for Industrial Heating," containing illustrations showing some of the many applications of electricity for heating.

ARC-WELDING EQUIPMENT. Lincoln Electric Co., Cleveland, Ohio. Bulletin treating of the Lincoln automatic arc welder of the tractor type for making lap and butt welds on large tank floors, roofs, large pipe, and similar work.

LOCK-WASHERS. Shakeproof Lock Washer Co., 2501 N. Keeler Ave., Chicago, Ill. Circular illustrating various applications of Shake-

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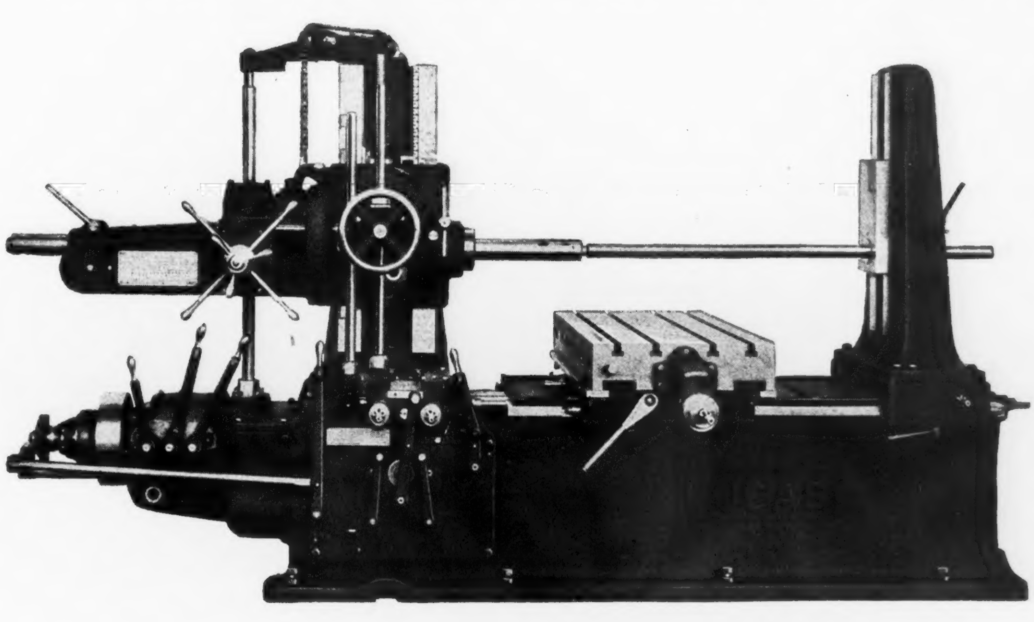

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proof lock-washers, as, for example, in radios, switch terminals, outlet boxes, etc.

WELDING EQUIPMENT. Fusion Welding Corporation, 103rd St. and Torrence Ave., Chicago, Ill. Bulletin 3, descriptive of Type T "Weldite" welding rods for hard-surfacing of tools and dies for working in metals, rocks, and soils.

FOUNDRY OVENS. Gehnrich Oven Co., Skillman Ave., and 36th St., Long Island City, N. Y. Bulletin illustrating and describing ovens for core baking, mold drying, pasting, blacking, and preheating, and also for ageing and normalizing castings.

NICHROME. Driver-Harris Co., Harrison, N. J. Pamphlet containing full-page illustrations showing various applications of Nichrome in carburizing, heat-treating, enameling and other processes where a heat-resisting alloy is required.

MOTOR-GENERATOR SETS. Roth Bros. & Co., 1400 W. Adams St., Chicago, Ill. Bulletin illustrating and describing Roth motor-generator sets, which are built in two- and four-bearing types and in sizes from 1/4 to 100 kilowatts, inclusive.

HEAT-TREATING EQUIPMENT. Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa. Catalogues 86, 87, and 93 dealing, respectively, with optical pyrometers, potentiometer pyrometers, and the Homo method for production tempering.

DIESEL ENGINES. Buckeye Machine Co., Lima, Ohio. Twenty-four-page catalogue, illustrating and describing in detail the Buckeye new vertical Diesel engine of the four-cycle type. Copies of the calalogue will be sent to those interested upon request.

RADIAL DRILLING MACHINES. United Machine Tool Corporation, 75 West St., New York City. Circular illustrating and describing Braun heavy-duty radial drilling machines, listing the advantages that the builders particularly wish to emphasize in these machines.

MOTORS. U. S. Electrical Mfg. Co., Los Angeles, Cal. Bulletin dealing with the process of insulating motors with asbestos in place of the materials commonly used for this purpose. The method of applying the asbestos and the results of the application are described.

LIGHTING EQUIPMENT. Cooper Hewitt Electric Co., Hoboken, N. J. Pamphlet entitled "Why Cooper Hewitt Light is Better than Daylight," containing information on the Cooper Hewitt system of lighting and showing illustrations of its application in various plants.

MILLING MACHINES. Kearney & Trecker Corporation, Milwaukee, Wis. Catalogue entitled "Milling Faster for an Industry that Flies." This booklet presents, in pictorial form, a story of the part Milwaukee milling machines are playing in the new airplane engine industry.

FLEXIBLE COUPLINGS. Brown Engineering Co., 133 W. 3rd St., Reading, Pa. Bulletin 28, descriptive of the features of Kanti-Lever flexible couplings. The illustrations show a wide variety of applications of these couplings, and prices and dimensions are given in tabular form.

TWIST DRILLS. Morse Twist Drill & Machine Co., New Bedford, Mass. Circular illustrating some typical examples of the Morse line of tools, which includes drills, cutters, reamers, taps and dies, arbors, chucks, mandrels, counterbores, taper pins, screw plates, sockets, and sleeves.

STRAIGHTENING PRESSES. Metalwood Mfg. Co., Leib and Wight Sts., Detroit, Mich. Catalogue describing the Metalwood line of hydraulic straightening presses, which includes eight types and sixteen sizes ranging from 10 to 200 tons capacity and covering a wide field of applications.

RIVETING MACHINES. United Machine Tool Corporation, 75 West St., New York City. Circular illustrating and describing electro-mechanical riveting machines for structural shops, having capacities for rivets up to 1 5/8 inches, and especially designed with a view to economical power consumption.

FLEXIBLE COUPLINGS. Poole Engineering & Machine Co., Baltimore, Md. Handbook covering Poole flexible couplings. The advantages of these couplings and their special features are pointed out, and the various types are illustrated and described. A number of typical installations are also shown.

GRINDING WHEELS. Charles H. Besly & Co., 120-B N. Clinton St., Chicago, Ill. Booklet descriptive of Besly "Titan Steelbacs," a new development in the line of abrasive wheels, which eliminates the necessity of the disk grinder user cementing and pressing on abrasive disks to the steel disk wheels of his machine.

GEAR-CUTTING MACHINES. Gleason Works, 1000 University Ave., Rochester, N. Y. Folder prepared for distribution at the National Machine Tool Builders' Exposition in Cleveland, showing the Gleason bevel gear cutting machines exhibited. Illustrations, brief descriptions, and specifications of each machine are included.

MILLING CUTTERS. Thurston Mfg. Co., Providence, R. I. Catalogue G, covering "Thurco" milling cutters, saws, and die milling machines. A complete list of the milling cutters and saws, including dimensions and prices, is given. The section devoted to die milling machines contains full-page illustrations of the various styles, and complete specifications.

SMALL TOOLS. National Twist Drill & Tool Co., Detroit, Mich. Wall chart containing table of decimal equivalents of wire, letter and fractional size drills, and table of tap drill sizes based on 75 per cent maximum thread, as well as hints for twist drill users relating to the grinding of drill points, causes of fracture of twist drills, speeds and feeds, and lubricants.

NICKEL CAST IRON. International Nickel Co., 67 Wall St., New York City. Pamphlet dealing with the subject of nickel cast iron from the point of view of both theory and practice. The bulletin presents the relative characteristics of plain and nickel-bearing cast iron, and describes ten of the more important features of the alloy cast iron, as well as actual applications.

MATERIAL HANDLING EQUIPMENT. Cleveland Electric Tramrail Division of the Cleveland Crane & Engineering Co., Wickliffe, Ohio. Circular showing the use of the Cleveland tramrail drop sections on various classes of work. Circular entitled "Time to Change from Obsolete Floor Methods to Cleveland Tramrail Overhead System," illustrating the use of this system for handling and storing raw material.

STORAGE BATTERIES. Edison Storage Battery Co., Orange, N. J. Bulletin entitled "Three Steps in Materials Handling that Cut Costs and Increase Profits," describing the basic facts underlying materials handling operations and the factors that must be dealt with in carrying out a definite program of economy. Special attention is called to the part that electric trucks, and hence storage batteries, play in effecting economies.

LUBRICATING SYSTEMS. Keystone Lubricating Co., 21st, Clearfield, and Lippincott Sts., Philadelphia, Pa. Circular illustrating and describing a new completely automatic grease lubricating system known as the "Pneuma-Lectric" system. The circular outlines the advantages of this new system and describes its operation. A wiring diagram is included. The installation of this system in a large plate mill is illustrated.

SHEARS, PUNCHES, AND PRESSES. Henry Pels & Co., Inc., 90 West St., New York City. Bulletin SP-29, illustrating and describing heavy shears and presses built with steel plate frames, including combination punches and shears, structural punches, heavy-duty scrap and plate shears, billet shears, gate shears, angle, bar, and tee shears, and heavy-duty presses. Bulletin MB-29, illustrating and describing combination shears and punches, also built with steel plate frames.

MOTORS. Wagner Electric Corporation, 6400 Plymouth Ave., St. Louis, Mo. Bulletin 165, descriptive of seven types of squirrel-cage motors. The bulletin is divided into several sections, one discussing cost, performance and delivery; another analyzing and comparing the starting and running characteristics of the various types of squirrel-cage motors; and other sections devoted to detailed description of construction, ventilation, lubrication, and mechanical details. Speed torque curves and a table of comparative prices are included.

LATHES. Monarch Machine Tool Co., Sidney, Ohio. Booklet containing information on the installation and maintenance of lathes. Among the points covered are tools required for proper leveling; testing for accuracy; care and lubrication of apron; proper method of changing spindle speeds; how to adjust the driving clutch; oiling the motor; how to tighten packing glands; adjusting the spindle; and how to use the taper attachment. The last chapter, entitled "Questions and Answers," presents various unusual problems of lathe operation and suggests the correct solutions.

ELECTRICAL EQUIPMENT. General Electric Co., Schenectady, N. Y. Bulletins GEA-25C, 83A, 151B, 181B, 197B, 211A, 241B, 261A, 957A, 1128, 1133, 1146, 1152, and 1157, dealing, respectively, with GE line breaker equipment; enclosed magnetic reversing switches; motor drives for rolling mills; alternating-current enclosed magnetic switches; mechanical-drive turbines, Type D-54; oil circuit breakers; oil-well pumping equipment; electric heat in industry; mechanical-drive turbines, Type D-53; steel-panel switchboards; mechanical-drive turbines, Type D-52; electric furnaces; synchronous motors for pumping, and strip heaters.

BALL BEARINGS. Gurney Ball Bearing Co., Jamestown, N. Y., has published a manual on ball bearings which contains a variety of information on ball bearings arranged in Handbook form. The book is carefully indexed, and is provided with a thumb index so that any subject can be readily located. In addition to covering fourteen different types of ball bearings, the manual contains engineering data regarding loads, safety factors, limiting speeds, selection of the right type and size of bearing, etc. One section of the book deals with bearing fits and shoulders, and there are thirty pages devoted to design and lubrication. The manual contains a total of 202 pages, and should be of interest and value to designers and engineers.

POWER TRANSMISSION EQUIPMENT. Dayton Rubber Mfg. Co., Dayton, Ohio. Catalogue 102, containing a complete list of Dayton cog-belt drives. The catalogue is divided into eight sections, the first containing a general description of this V-belt type of drive; the second, installation views of Dayton cog-belt drives; the third, a list of standard stock drives from 2 to 25 horsepower, inclusive; the fourth, standard stock drives from 10 to 100 horsepower, inclusive; the fifth, non-stock drives from 50 to 100 horsepower, inclusive; the sixth, non-stock drives from 100 to 300 horsepower, inclusive; the seventh, special non-stock drives; and the eighth, prices on special non-stock drives and special pulley features. The sections are printed on different colored paper for ready reference.